A CASE STUDY REVIEW OF THE EMERSON ELECTRIC SITE USING A METHOD OF CHARACTERISTICS MODEL TO DETERMINE THE SUCCESS OF THE PUMP AND TREAT REMEDIATION

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PREFACE

Emerson Electric Company was one of twenty four cases studied by the Environmental Protection Agency in order to evaluate the effectiveness of pump and treat systems. I intend, through the use of computer modeling, to address the conclusions drawn by the EPA from their study as they relate to the Emerson Electric site.

I wish give special thanks to my advisor, Dr. A. K. Tyagi, for giving me long distance support throughout my thesis work and for giving me my first exposure to groundwater modeling, an area that I have come to love.

I would also like to thank my other committee members, Dr. Lyle Bruce and Dr. John Veenstra, for their assistance during my coursework and for giving validation to my decision to enter this field of work.

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NOMENCLATURE

ADIP	Alternating-Direction Implicit Procedure
b	saturated thickness of the aquifer, L
C	concentration of the dissolved chemical species, M/L^3
C'	concentration of the dissolved chemical in a source or sink fluid, M/L^3
$C_{l,m}$	concentration at node (l, m), which represents a cell adjacent to (i, j) and on a line that starts at (i, j) and extends through the coordinates of the point (n) of interest, M/L^3
C_n^*	concentration of the nth point in the cell (i, j), M/L^3
cfs	cubic feet per second
D_{ij}	coefficient of hydrodynamic dispersion (a second order tensor), L^2/T
D_L	longitudinal dispersivity
D_T	transverse dispersivity
DCA	1,1-dichloroethane
DCE	1,1-dichloroethylene
DNAPL	dense non-aqueous phase liquid
EM	electromagnetic
EPA	U.S. Environmental Protection Agency
ESE	Environmental Science and Technology
FDER	Florida Department of Environmental Regulation
foc	fraction organic carbon
fps	feet per second

ft/ft	feet per foot
ft/yr	feet per year
gpm	gallons per minute
h	hydraulic head, L
i	index in the x dimension
j	index in the y dimension
k	index in the time dimension
Kd	soil distribution coefficient
koc	organic carbon partition coefficient
M_f	net mass flux, M
ΔM_s	change in mass stored in the aquifer, M
MEK	methyl ethyl ketone
MIBK	methyl isobutyl ketone
MOC	method of characteristics
N_p	total number of points initially placed in a cell
NAPL	non-aqueous phase liquid
POTW	publicly owned treatment works
ppb	parts per billion
ppm	parts per million
q_w	volumetric rate of withdrawal or recharge at the (i, j) node, L^3/T
R_f	retardation factor, dimensionless
R_m	mass residual
S	storage coefficient, dimensionless
sf/s	square feet per second
SIP	Strongly Implicit Procedure
T_{ij}	transmissivity tensor, L^2/T

t	time, T
Δt	increment in the time dimension
TCA	1,1,1-trichloroethane
TCE	1,1,1-trichloroethylene
USGS	U.S. Geological Survey
$\lvert v \rvert$	magnitude of the velocity, L/T
v_i	seepage velocity in the direction x_i, L/T
v_m	component of velocity in the m direction, L/T
v_n	component of velocity in the n direction, L/T
VOC	volatile organic compound
W	W(x,y,t), the volume flux per unit area (positive for outflow and negative for inflow), L/T
Δx	increment in the x direction
x_i	Cartesian coordinate, L
x_j	Cartesian coordinate, L
Δy	increment in the y direction
α_{ijmn}	dispersivity of the aquifer, L
ϵ	effective porosity of the aquifer, dimensionless
γ	fraction of the grid dimension that particles will be allowed to move
λ	decay constant, T
ρ_b	bulk density, M/L

CHAPTER I

INTRODUCTION

In 1989 the U.S. Environmental Protection Agency (EPA) published Evaluation of Ground-Water Extraction Remedies, the first phase of a report compiling the results of a study initiated to show where and how groundwater extraction systems are being used throughout the United States, how their performance compares with expectations and what factors affect their success. The study was comprised of data gathered from remedial investigation and feasibility studies reports, and on annual or quarterly performance monitoring reports, mostly current through 1988. Most of the data gathered on groundwater extraction systems support the idea that their performance falls short of expectations and the goal of remediation is usually determined to be impractical and subsequently revised to a plume containment objective (EPA, 1989).

Study Methods

The EPA study was an empirical one, divided into two major efforts. The first was the gathering of general information on 112 hazardous waste sites around the country. This data included site locations, contaminant types, geologic data, the remedial objectives, and the status of the remediation. This information was obtained from EPA staff members involved in Resource Conservation and Recovery Act (RCRA) and hazardous waste sites and from state environmental offices in California, Florida, Minnesota, New Jersey and New York. The majority of the sites in this element of the study had not had extraction systems in place long enough to generate any useful performance data.

The second element of this EPA study compiled detailed information consisting of geologic and hydrogeologic data, contaminant distribution, remediation goals, design of the extraction system and data on the performance of extraction systems at selected sites where ground water extraction systems had been in place long enough to produce a record of system performance. For Phase I, a series of nineteen case studies was prepared, drawing tentative conclusions about the effectiveness of the extraction systems and the site-specific factors affecting them. In 1991, a Phase II report, updating the evaluation of seventeen of the original nineteen cases, was published. No new data was available for update on two of the sites and this second phase also added five new sites to the study.

At the conclusion of Phase II, the Emerson Electric site was the only reported successful aquifer cleanup. Since these remedial success claims were based on limited monitoring data, they are open to question. This paper will address the following conclusions of the EPA study as they apply to Emerson Electric, aided by the creation of a computer model of the site.

Conclusions Drawn by the EPA Study

Several important conclusions were drawn from the EPA study. Inadequate data collection, both prior to and after system design precluded the accurate assessment of contaminant movement and the groundwater system response to stress. However, most systems did maintain hydraulic control of the contaminant plume and were able to extract a substantial mass of contaminant from the aquifer.

Pump-and-treat systems did show, initially, a significant recovery rate for contaminant but eventually leveled off and it was unclear whether the asymptote was due to successful remediation or poor placement of monitoring wells.

At 14 of the 24 sites studied, the potential presence of NAPLs was not addressed. At five other sites NAPLs were addressed only because they were discovered unexpectedly. Since NAPLs were not addressed at most of the sites, the system design was implemented for dissolved phase contaminants only and may have worked as expected for these contaminants but the time to remediate would have been significantly longer than anticipated.

Dense nonaqeuous phase liquids (DNAPLs) were encountered at sites where the dissolved contaminants in the groundwater were as low as 15 percent or less of their respective solubilities, indicating that low groundwater concentrations do not preclude the presence of NAPLs. Chemical data collected during operation from 20 of the sites were consistent with the presence of DNAPLs although the immiscible phase was rarely sampled or observed.

Groundwater remediation must be treated as an iterative process and this was recognized at all of the operation sites (EPA, 1991).

CHAPTER II

LITERATURE REVIEW

Background of the Problem

Site History

The Emerson E&S Division-Orlando, Miller Street plant in Altamonte Springs, Florida, was a manufacturer of various electrical components for the United States Department of Defense and the aerospace industry, operating from January of 1979 until the mid-1980's (Fig. 1). Activities at this site included flow soldering, resin spray coating, assembling, oven drying, metal treating, spray painting, and machining (ESE, 1982). An inspection of the site, in October of 1981, by Florida Department of Environmental Regulation (FDER) inspectors, revealed that a current plant practice, started in January of 1980, included releasing metal filming rinse water into a septic tank and tile drain field on the property without pretreatment. As a result of this inspection, the FDER directed Emerson to develop a waste treatment and disposal system and to study the current groundwater conditions at the site. Emerson Electric stopped discharging the untreated wastewater in November of 1981, and subsequently collected it and transported it to a

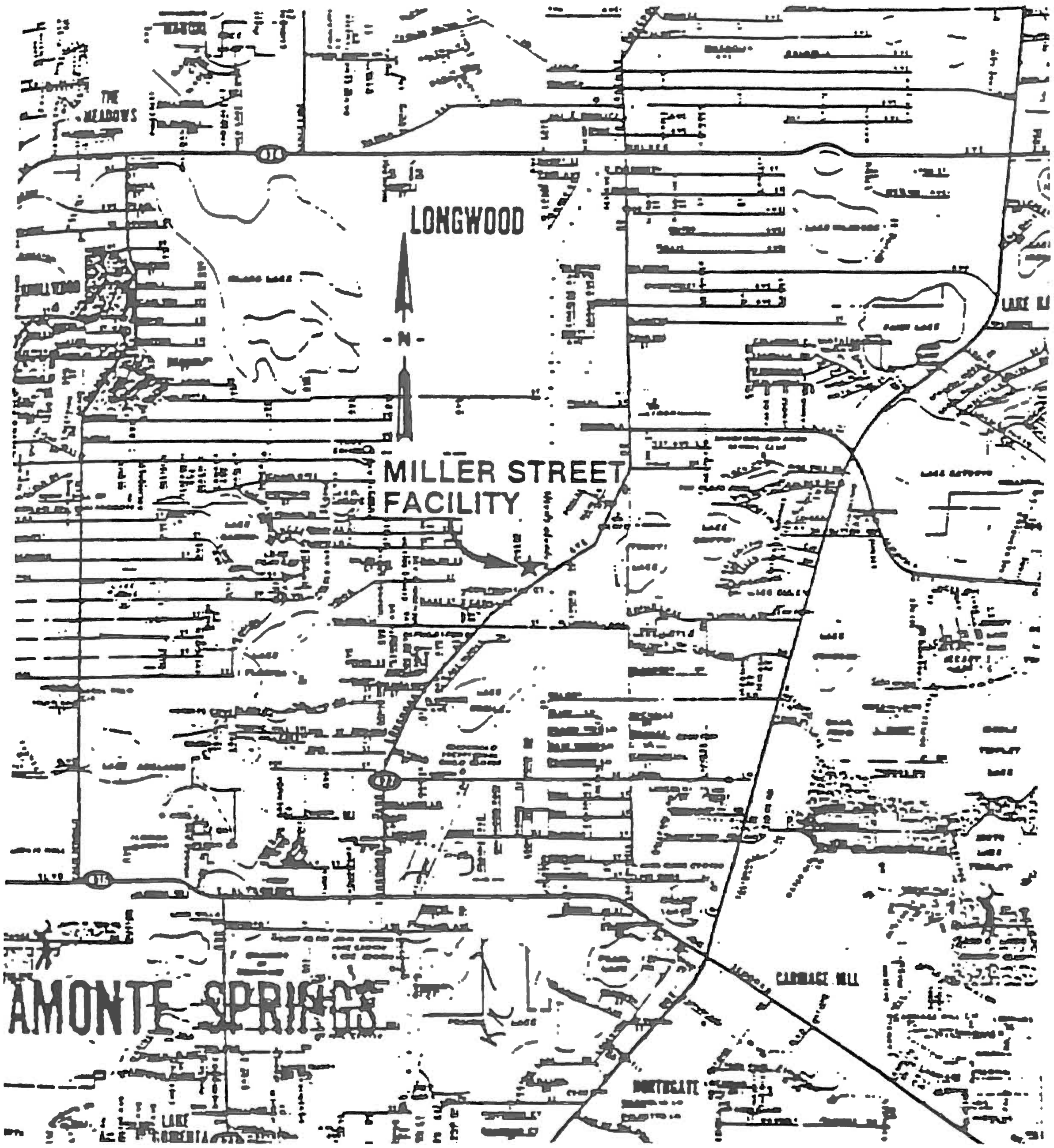

Figure 1. Location Map--Emerson Electric Site

recycling facility in Indiana (ESE, 1982).

In March of 1982, Emerson Electric contracted with Environmental Science and Engineering, Inc. (ESE) to determine the extent of the contamination at their plant site. ESE performed a geophysical survey along the south, east, and north sides of the facility. Existing pavement prevented the survey of the west side. Electromagnetic (EM) and electrical resistivity techniques were used to provide data for locating potential pathways for groundwater and leachate migration and to detect electrical conductivity anomalies possibly indicating the presence of a contaminant plume. Although buried metal debris interfered with the survey, ESE was able to determine from the information available that the only area of high conductivity was southwest of the Emerson plant, pointing to the presence of buried debris, highly organic soils and/or groundwater contamination (Fig. 2). ESE was unable to conclude from this survey whether or not groundwater contamination was present, but did express that since the survey detected no high conductivity in or near the septic tank percolation field that this possibly indicated that groundwater flow was dominantly vertical (ESE, 1982). Comparison by the EPA of horizontal and vertical flow rates supports the opposite conclusion (EPA, 1989).

ESE installed a groundwater monitoring system, in August of 1982, comprised of six wells, four wells in the upper, water table aquifer into the first clay layer

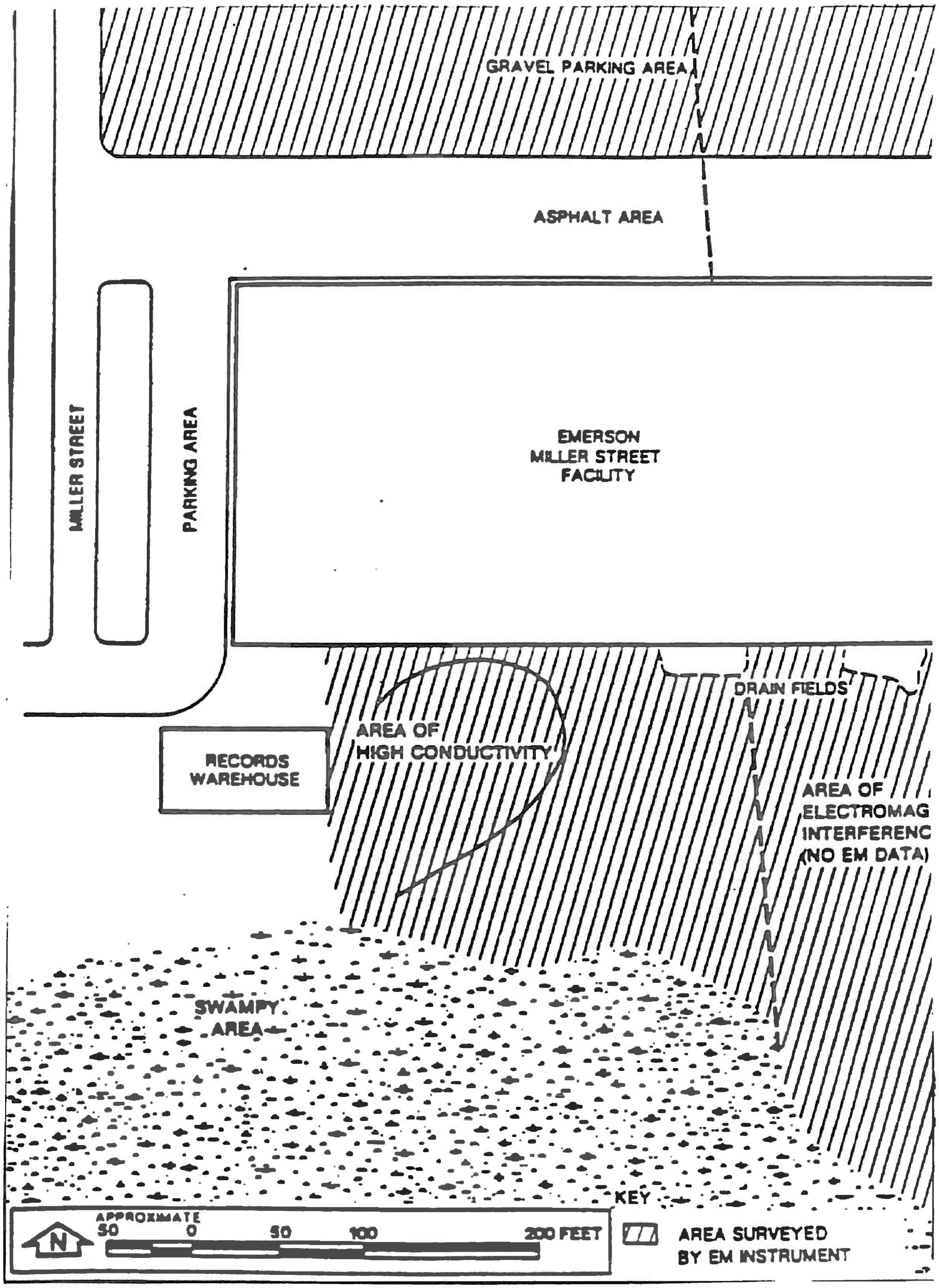

Figure 2. Conductivity Survey--Emerson Electric Site

approximately 50 feet, ES1, ES2, ES3, and ES4 and two wells, ED1 and ED2, either 50 feet deeper that the first four or into the top of the Floridan Aquifer, whichever was encountered first (Fig. 3). The specifications, provided by ESE for the groundwater monitoring, required that the water be analyzed for the parameters that were known or suspected to have been discharged in the filming process wastewater (cadmium, lead, fluoride, and nitrate-nitrogen). The wells were to be sampled weekly for four weeks. After the results of the first set of samples were known, 33 volatile organic compounds (VOCs) was added to the parameters to be sampled and analyzed for in Well ES4 during the second sampling effort. Those detected in ES4 were benzene, 1,1-dichloroethane (DCA), 1,1-dichloroethylene (DCE), trans-1,2-dichloroethene, ethylbenzene, methylene chloride, tetrachloroethene, 1,1,1-trichloroethane (TCA), 1,1,2-trichloroethane, trichloroethene (TCE), toluene, acetone, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK) (ESE, 1982).

A study of previous waste disposal practices at Emerson Electric revealed that used paint filters may have been buried on the south side of the manufacturing building. A few shallow holes, which were hand dug, in this area uncovered a 2 to 6 inch layer of used paint filters. An EP toxicity test on surrounding soil and paint filter material samples indicated that the filters were high, up to 2,480 ug, in leachable chromium. In response to this finding, a

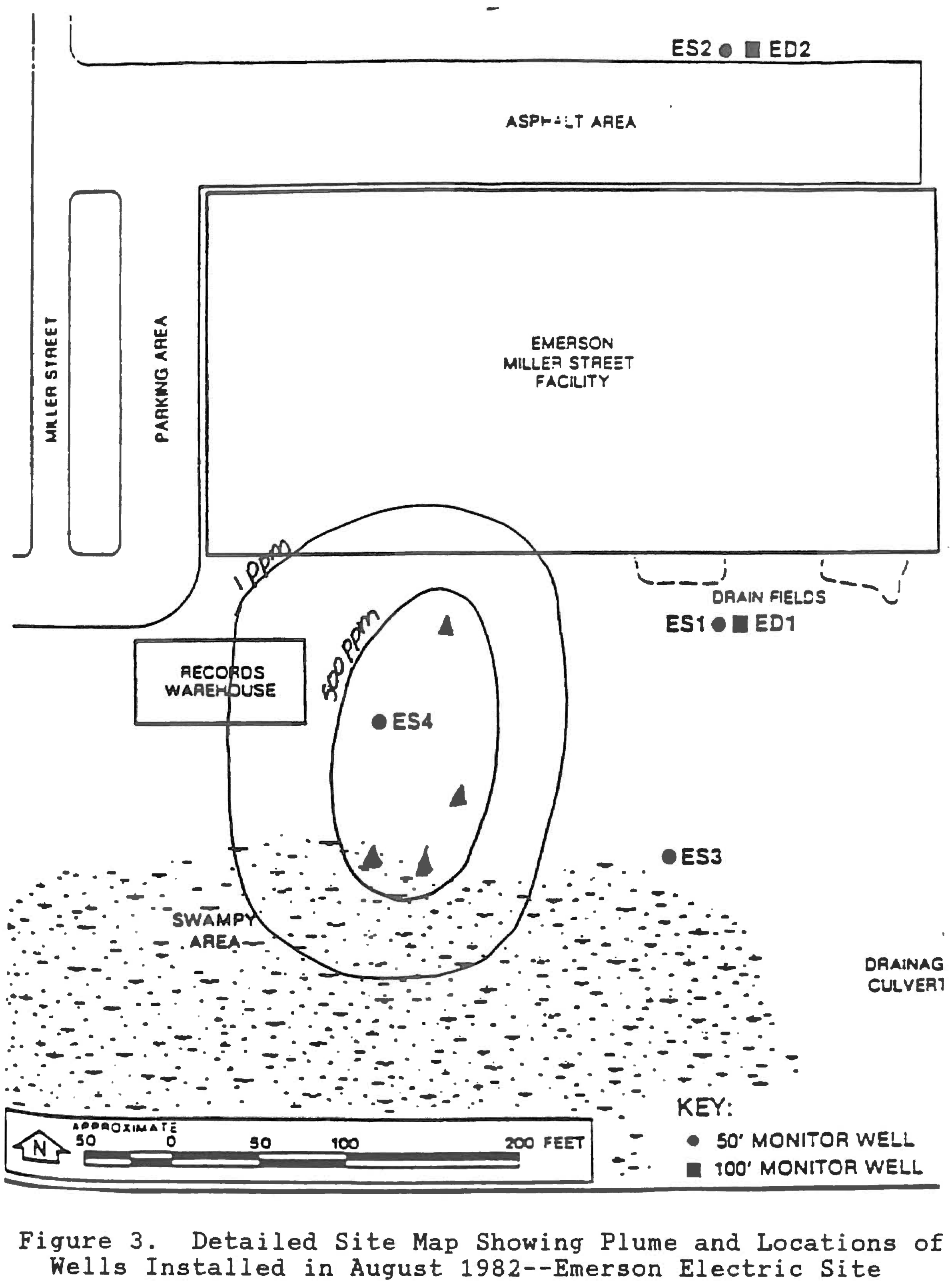

Figure 3. Detailed Site Map Showing Plume and Locations of Wells Installed in August 1982--Emerson Electric Site

soil sampling effort was undertaken. In November of 1982 the paint filters were excavated by ESE (ESE, 1982).

In February of 1984, Emerson Electric proposed a remedial action plan to the FDER. The plan proposed installing four new pumping wells in the area of maximum contamination. Groundwater would be pumped from the shallow aquifer by each new well and from ES4 at a combined rate of 30 gallons per minute (gpm) and discharged into the community sewer which delivers it to the Altamonte Springs publicly owned treatment works (POTW) (ESE, 1984).

ESE determined by creating a adsorption/desorption model based on the soil distribution coefficients of the contaminants present, that it would require the withdrawal of eight or nine pore volumes of clean water through the contaminated aquifer zone in order to reduce the levels of regulated VOCs (DCA, TCA, methylene chloride, benzene, and DCE) to below analytical detection levels. The time estimated to complete this withdrawal was nine months (ESE, 1984). The State of Florida issued a consent order in October of 1984 requiring that Emerson Electric to deliver the completed remediation system to the FDER and to reimburse the FDER and the Altamonte Springs POTW for the cost of operating and maintaining the pumping system for the nine month period. The system was delivered to the FDER on December 14, 1984 and the payments made, freeing Emerson Electric from any further liability (EPA, 1989).

The actual remediation took until June of 1987 to complete, then the system was shut off by the FDER. Groundwater samples taken in September of 1987 and May of 1988 indicated that contaminant concentrations were at levels low enough to allow the site to be removed from the State Action Site list and this was done in January of 1989 at the recommendation of the FDER (EPA, 1989).

Geology

The Emerson Electric plant was built on the site of a swamp which had been filled with two to ten feet of sandy fill material and construction debris prior to the arrival of Emerson Electric in 1979 (EPA, 1989). An investigation by ESE of boring logs and well records obtained from the United States Geological Survey (USGS) office in Orlando and the St. Johns River Management District office in Palatka, Florida showed that beneath this fill, is a layer 20 to 50 feet thick of unconsolidated sand. The Hawthorne Formation, a layer of interbedded clay and sandy phosphatic limestone with a thickness of 20 to 60 feet, underlies the sand. Underlying the Hawthorne Formation is the Ocala Limestone, which is the upper unit of the Floridan Aquifer, an important source of water in this area (Fig. 4). The site lies in an area determined by USGS to give more than 10 inches of recharge per year to the Floridan Aquifer (ESE, 1982).

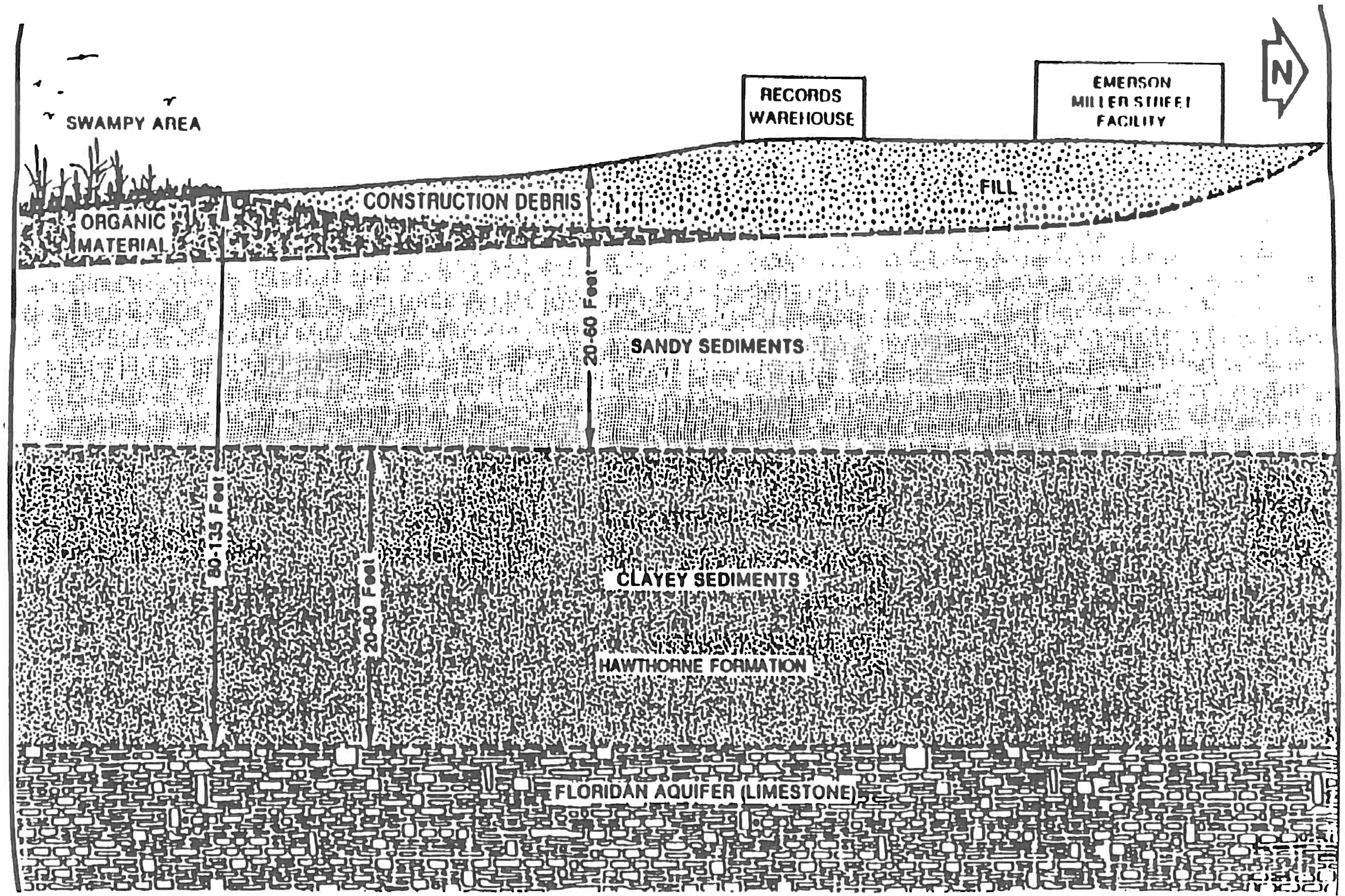

Figure 4. Geologic Cross Section--Emerson Electric Site

Hydrogeology

The shallow sand layer is an unconfined water table aquifer with a depth to water which ranged from 0.56 to 2.98 feet below grade at the four monitoring well locations in August and September 1982 (ESE, 1982). The potentiometric surface of the shallow aquifer as measured on September 2, 1982, from the four fully-screened, shallow, monitoring wells was plotted by ESE and the flow in this upper aquifer is shown to be to the southwest (Fig. 5). A series of single-well aquifer tests (slug tests) conducted in October 1982, determined the hydraulic conductivity of the shallow aquifer to be around 2.35e-05 feet per second (fps) (Table I). ESE estimated the horizontal groundwater velocity to be 5.15 feet per year (ft/yr), (ESE, 1982) however, the authors of the EPA study calculated it at 25 ft/yr based on the above conductivity, an assumed porosity of 30 percent, and a horizontal gradient of 0.01 feet per foot (ft/ft) taken from the potentiometric surface map (EPA, 1989).

TABLE I

AVERAGE HYDRAULIC CONDUCTIVITY (FT/SEC)
OBTAINED FROM SLUG TESTS

Well Number	Method: Bouwer and Rice	Method: Hvorslev
ES1	0.7378e-05	0.9131e-05
ES2	0.2541e-04	0.5498e-04
ES3	0.2751e-04	0.7496e-04
ES4	0.3351e-04	0.4883e-04
ED1	0.5435e-05	0.8522e-05
ED2	0.1065e-05	0.1079e-04

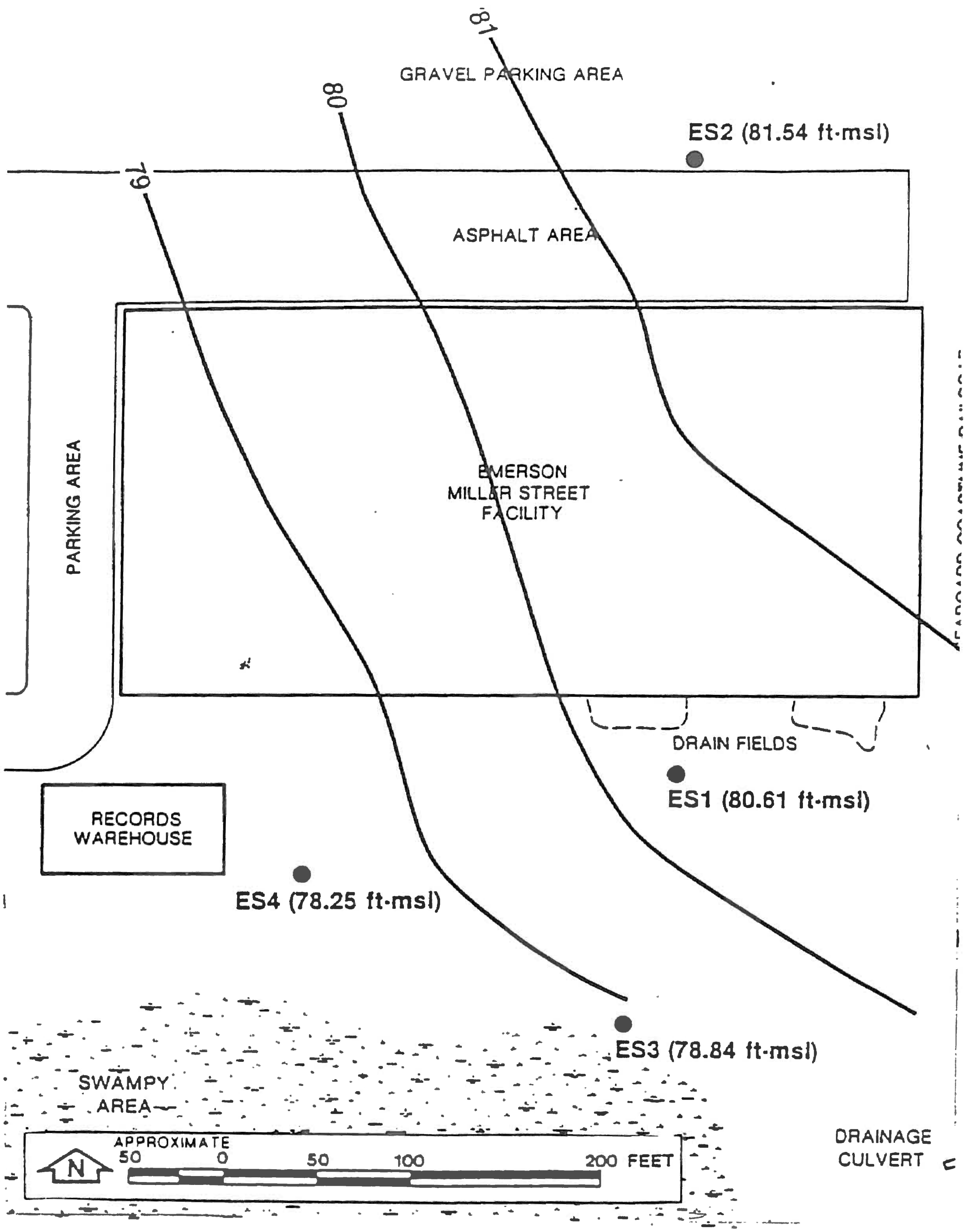

Figure 5. Potentiometric Map of Shallow Aquifer (September 2, 1982)--Emerson Electric Site

Waste Characteristics and Potential Sources

The Emerson Electric plant operated in a leased building which was constructed in 1973 and partially utilized as a warehouse by various tenants until Emerson leased it as a warehouse in 1979. Emerson gradually converted the building to a production space, completing the conversion in 1981. The location of this facility was in an isolated industrial park which had been used as a dumping ground for the public in the area (ESE, 1982). This debris from public disposal offered one of the possible sources of contamination at this site. The wastewater discharged through the plant's septic system to drain fields in the southeast part of the plant between January of 1980 and November of 1981 was the other possible source. The estimated volume of wastewater released to the septic system was 34,650 gallons (EPA, 1989).

The principal contaminants of concern at the Emerson Electric site were acetone, MEK, MIBK, toluene, DCE, DCA, TCE, TCA, benzene, and chromium. ESE (1982) tabulates the concentrations of contaminants observed at different sampling periods for the six monitoring wells. After the results of the first sampling trip showed that well ES4 had the lowest pH, 4.6, and a conductivity which was three to nine times higher than the other wells, the group of VOCs mentioned earlier was added to the list of parameters for that well. The third sampling trip was expanded to add VOC analyses for all wells. VOCs were detected mainly in Well ES4, although small amounts of DCA (260 ppb), DCE (28 ppb) and TCA (110 ppb) were found in Wells ES1 and ES3. None were detected in Well ES2, the upgradient well (ESE, 1982).

ESE drew six conclusions from their contamination assessment at Emerson Electric: "1) No VOC contamination was detected in the Floridan aquifer. 2) Emerson Electric ha[d] undertaken remedial actions to remove potential sources of contamination by ceasing to discharge the wastewater and excavating the buried paint filters. 3) The source of the metals contamination is probably not the wastewater discharge via the septic system by Emerson Electric since contaminant level in the well closest to the drain field (ES1) were lower than those in the downgradient wells. 4) Although some elevated levels of lead and chromium were detected in the shallow groundwater, significant contamination of the shallow aquifer system with respect to metals has not occurred. 5) Contaminant migration and the rate of groundwater movement at the site is limited by geohydrologic conditions, hydraulic conductivity, and water level gradients. 6) Well ES4 indicates the presence of volatile organic compounds. The VOCs appear to be limited in areal extent as the other downgradient wells show only low levels of organics" (ESE, 1982). ESE reported that the contamination was probably prior to the Emerson Electric operation at the site and was the result of a single release of approximately 500 gallons of mixed solvents between 1975 and 1978. The buried debris at the site may also have contributed to contamination. The source of the observed contamination is uncertain (EPA, 1989).

Since the distribution of the contaminant plume at the Emerson Electric site was never well characterized, the six monitoring wells installed in August 1982 provide the only information available to evaluate the magnitude of the contamination. ESE used a 500 parts per million (ppm) VOC contour in their modelling, determined from the sand point data (ESE, 1984). Because some contamination was evident at all of the monitoring wells, the contaminant boundary must have stretched outward from the area delineated by the six wells and, therefore, its lateral extent can only be estimated (EPA, 1989).

Remediation

System Design of the Remediation

The objective of the remediation at Emerson Electric was to reduce the concentration of regulated VOCs at the site to below analytical detection levels (ESE, 1984). In February of 1984, ESE presented a plan to the FDER which consisted of five extraction wells, ES4 and four added wells, located in the plume at a depth of 50 feet and screened over the bottom 40 feet. Each well was to be pumped at 6 gpm for a total system pumping rate of 30 gpm.

Water extracted by the system was discharged into the municipal sanitary sewer destined for treatment at the Altamonte Springs POTW. Progress was to be charted by the amount of contaminant detected in Well ES4.

Placement of the four additional wells were determined by drawing the potentiometric contours and equally spaced groundwater flow trajectories along the 500 ppm VOC boundary, which ESE determined from a detailed sand point grid, for different well configurations. These trajectories terminate at the proposed extraction wells. The well configuration with the shortest travel time calculated from 18 points along the plume boundary was the one selected. ESE estimated that by pumping nine pore volumes of water from the contaminated zone, all organic contaminant concentrations, except those for toluene and ethylbenzene would be reduced to below analytical detection levels. Toluene and ethyl benzene were projected to be reduced to 70 part per billion (ppb) and 80 ppb respectively, less than ten percent of the federal regulated standard (ESE, 1984). The time estimated to complete this remediation was predicted to be nine months.

Monitoring was performed at Emerson by taking composite samples of the water extracted by the five wells from January 1985 to September 1987 and individually sampling three of the wells in May of 1988. All monitored contaminants in the three wells were below detection limits.

The results of monitoring at wells ES1, ES3, and ED1 were not reported (EPA, 1989).

Performance of the Remediation

The only criteria available for assessing the performance of the remediation at Emerson Electric are the results of the sampling effort during the actual remediation and post-termination. No water level measurements were ever taken to investigate the actual effects of pumping on the water table.

Figures 6 and 7 are time series plots of several of the contaminants. The plot shows that the concentrations of all contaminants plotted were reduced to non-detect by September of 1987. The EPA estimates that 4 kg TCA, 3.8 kg of DCE and 32 kg of MEK were removed before the contaminant concentrations were reduced to below detection limits by the remediation system (EPA, 1989).

Summary of Remediation

The actual time required to reduce the VOC concentrations to consistently below the standard levels was 33 months. Inaccurate estimates of retardation and plume delineation are the probable cause of the remediation taking longer than originally estimated. Because contaminant levels were reduced to below standards for all contaminants at the site and remained below standards for two rounds of post-termination monitoring, the FDER removed the site from

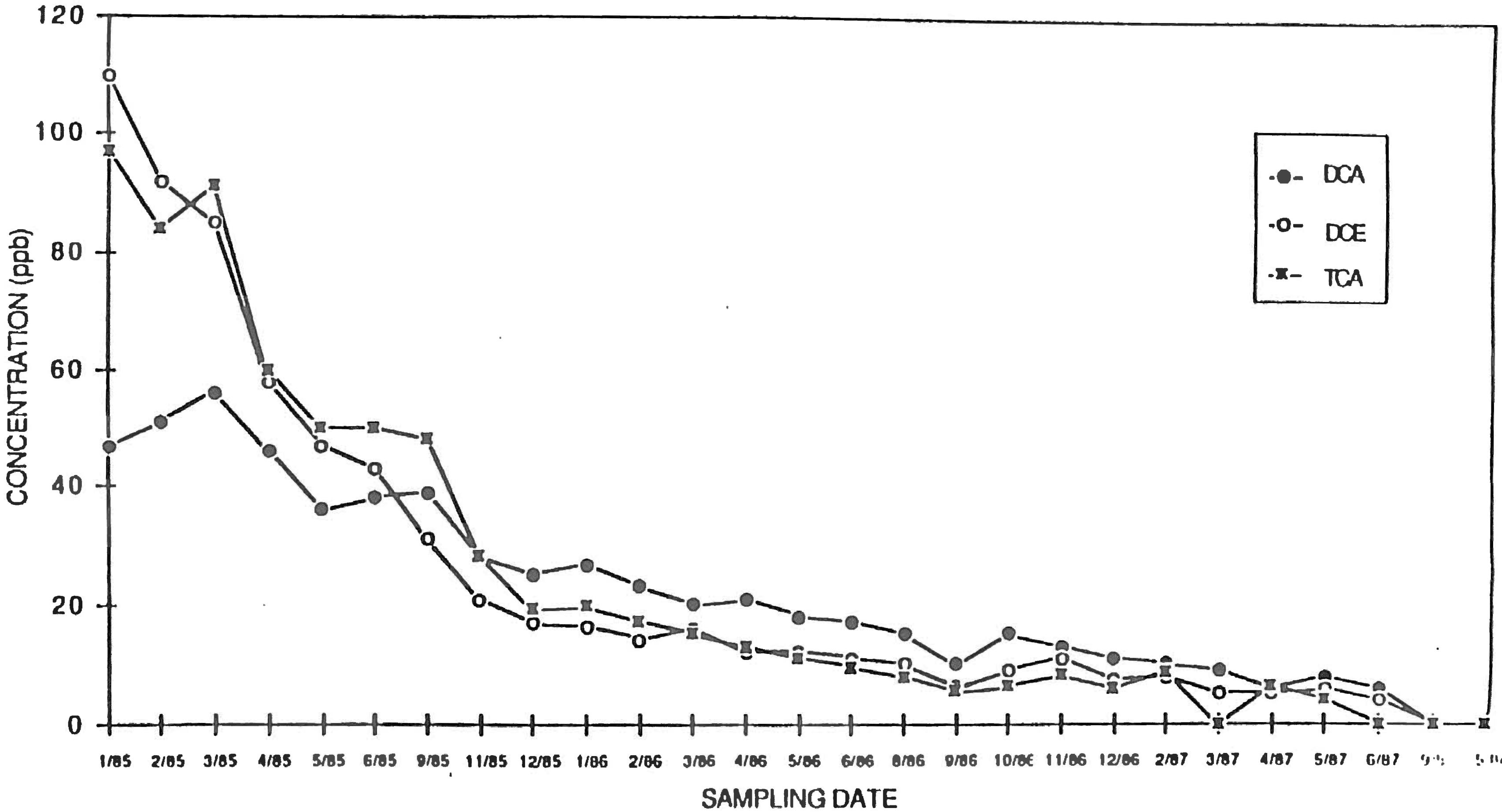

Figure 6. Time Series Plot of the Composite Concentrations of TCA, DCE, and DCA at the Emerson Electric Site

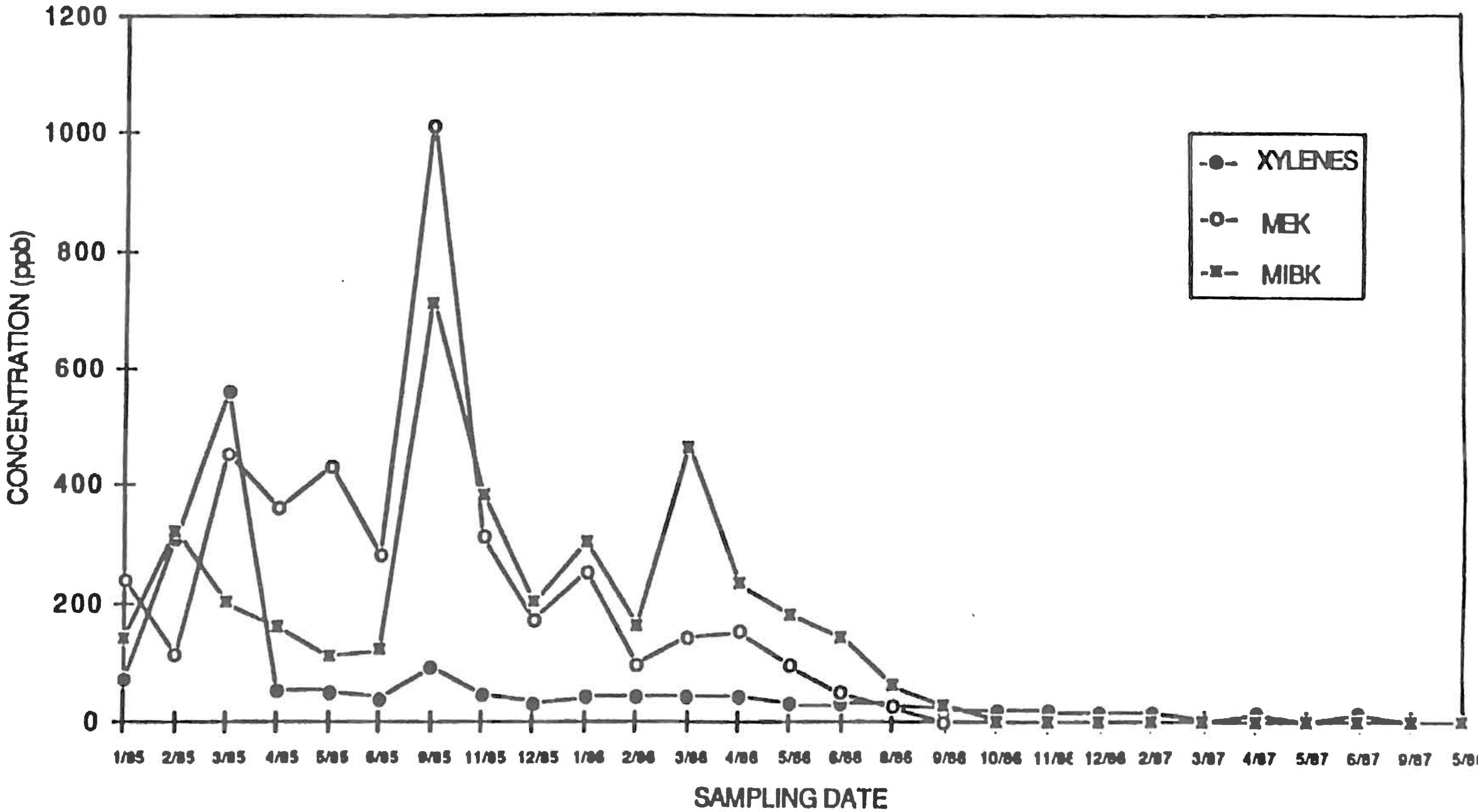

Figure 7. Time Series Plot of the Composite Concentrations of Xylenes, MEK and MIBK at the Emerson Electric Site

the State Action Site list in January 1989 (EPA, 1989).

Chapter III

DESCRIPTION OF U.S.G.S. TWO-DIMENSIONAL SOLUTE TRANSPORT MODEL "MOC"

Introduction

This chapter describes MOC, a two-dimensional computer model for calculating transient spatial concentration distribution of a non-reactive solute in a saturated groundwater system. It computes these changes that are due to four processes: 1) convective transport, in which dissolved chemicals are moving with the flowing groundwater; 2) hydrodynamic dispersion, in which molecular and ionic diffusion and small variations in the velocity of flow through the porous media cause the paths of dissolved molecules and ions to diverge from the average direction of groundwater flow; 3) fluid sources or sinks, where water of one composition is introduced into or removed from water of a different composition: and 4) reactions, in which some amount of a particular dissolved chemical may be added to or removed from the groundwater due to chemical and physical reactions in the water or between the water and the aquifer solids. The model assumes that 1) fluid density variations, viscosity changes, and temperature gradients do not affect the velocity distribution and 2) that no reactions occur that affect the concentration of the solute of interest. MOC does allow modeling heterogeneous and/or anisotropic aquifers.

MOC couples the groundwater flow equation, which describes the head distribution in the aquifer, with the solute-transport equation, which describes the chemical concentration in the system. MOC uses the Alternating-Direction Implicit Procedure (ADI) or Strongly Implicit Procedure (SIP) to solve the finite-difference approximation of the groundwater flow equation. The SIP procedure for solving the groundwater flow equation is most useful when areal discontinuities in transmissivity exist or when the ADI solution does not converge. MOC uses the method of characteristics to solve the solute transport equation. It uses a particle tracking procedure to simulate convective transport and a two-step explicit procedure to solve the finite-difference equation that describes the effects of hydrodynamic dispersion, fluid sources and sinks, and divergence of velocity. The explicit procedure is subject to stability criteria, but the program automatically determines and implements the time step limitations necessary to satisfy the stability criteria (Konikow, 1989).

Theoretical Background

Flow Equation

"[T]he transient two-dimensional areal flow of a homogeneous compressible fluid through a nonhomogeneous anisotropic aquifer can be written in Cartesian tensor notation as:

$$\frac{\partial}{\partial x_i}\left(T_{ij}\frac{\partial h}{\partial x_j}\right) = S\frac{\partial h}{\partial t} + W \qquad i,\ j = 1,2 \qquad (1)$$

where

T_{ij}	is the transmissivity tensor, L^2/T;
h	is the hydraulic head, L;
S	is the storage coefficient, dimensionless;
t	is the time, T;
$W = W(x, y, t)$	is the volume flux per unit area (positive sign for outflow and negative for inflow), L/T; and
x_i and x_j	are the Cartesian coordinates, L" (Konikow, 1978).

Transport Equation

The equation used to describe the two-dimensional areal transport and dispersion of a given nonreactive dissolved chemical species in flowing ground water may be written as:

$$\frac{\partial (Cb)}{\partial t} = \frac{\partial}{\partial x_i}\left(bD_{ij}\frac{\partial C}{\partial x_j}\right) - \frac{\partial}{\partial x_i}(bCV_i) - \frac{C'W}{\epsilon} \qquad (2)$$

$$i, j = 1, 2$$

where

C	is the concentration of the dissolved chemical species, M/L^3;
D_{ij}	is the coefficient of hydrodynamic dispersion (a second-order tensor), L^2/T;
b	is the saturated thickness of the aquifer, L;
C'	is the concentration of the dissolved chemical in a source or sink fluid, M/L^3;
V_i	is the seepage velocity in the direction x_i, L/T; and
ϵ	is the effective porosity of the aquifer (dimensionless).

The first term on the right side of the equation accounts for the change in concentration due to hydrodynamic dispersion. The second term represents the effects of advection while the third term describes a fluid source or sink (Konikow, 1978).

Dispersion Coefficient

Hydrodynamic dispersion is described by two processes. One process is mechanical dispersion, which depends upon both the flow of the fluid and the nature of the pore system through which the flow takes place. The second process is molecular and ionic diffusion, which because it depends on time, is more significant at low flow velocities. The separation between the two processes is artificial. The developers of the MOC model assumed for flowing ground water systems that the major contribution of dispersion is of mechanical nature instead of due to molecular and ionic diffusion.

The dispersion coefficient can be related to the velocity of groundwater flow by the equation:

$$D_{ij} = \alpha_{ijmn} \frac{V_m V_n}{|V|} \tag{3}$$

where

α_{ijmn}	is the dispersivity of the aquifer, L;
V_m and V_n	are components of velocity in the m and n directions, respectively, L/T; and
$\lvert V \rvert$	is the magnitude of the velocity, L/T.

For isotropic aquifers, the dispersivity tensor can be defined in terms of two constants, the longitudinal and transverse dispersivity and may be related to the dispersion coefficients by:

$$D_L = \alpha_L |V| \tag{4}$$

and

$$D_T = \alpha_T |V| \tag{5}$$

(Konikow, 1978).

Review of Assumptions

Several assumptions were made in the development of the previous equations. The following list of the main assumptions must be carefully evaluated before applying the model to a field problem.

1) Darcy's Law is valid and hydraulic head gradients are the only significant driving mechanism for fluid flow.

2) The porosity and hydraulic conductivity of the aquifer are constant with time, and porosity is uniform in space.

3) Gradients of fluid density, viscosity and temperature do not affect the velocity distribution.

4) No chemical reactions occur that affect the concentration of the solute, the fluid properties, or the aquifer properties.

5) Ionic and molecular diffusion are negligible contributors to the total dispersive flux.

6) Vertical variations in head and concentration are negligible.

7) The aquifer is homogeneous and isotropic with respect to the coefficients of longitudinal and transverse dispersivity (Konikow, 1978).

Numerical Methods

Because of the variable properties and complex boundary conditions of aquifers, exact solutions to the partial differential equations of flow and solute transport cannot be obtained, thus requiring the use of approximate numerical methods.

MOC uses a rectangular, block-centered, finite-difference grid for flux and transport calculations that defines the nodes at the centers of the rectangular cells. The grid size limit for flow calculations is 40 rows and 40 columns. The grid size limit for transport calculation is 20 rows and 20 columns that can be assigned to any area of the flow grid.

Flow Equation

When the coordinate axes are alined with the principal directions of the transmissivity tensor, the flow equation may be approximated by the following implicit finite-difference equation:

$$T_{xx[i-1/2,j]}\left[\frac{h_{i-1,j,k}-h_{i,j,k}}{(\Delta x)^2}\right] + T_{xx[i+1/2,j]}\left[\frac{h_{i-1,j,k}-h_{i,j,k}}{(\Delta x)^2}\right] + T_{yy[i,j-1/2]}\left[\frac{h_{i,j-1,k}-h_{i,j,k}}{(\Delta y)^2}\right]$$

$$+ T_{yy[i,j+1/2]}\left[\frac{h_{i,j+1,k}-h_{i,j,k}}{(\Delta y)^2}\right] = S\left[\frac{h_{i,j,k}-h_{i,j,k-1}}{\Delta t}\right] + \frac{q_{w(i,j)}}{\Delta x \Delta y}$$

$$+ \frac{K_z}{m}[H_s(i,j)-h_{i,j,k}] \tag{6}$$

where

i, j, k	are indices in the x, y, and time dimensions, respectively;
$\Delta x, \Delta y, \Delta t$	are increments in the x, y, and time dimensions, respectively; and
q_w	is the volumetric rate of withdrawal or recharge at the (i, j) node, L^3/T.

An iterative alternating-direction implicit (ADI) procedure solves the finite-difference equation numerically for each node in the grid. The ADI procedure can be concisely expressed as follows. The procedure divides each time step into two equal substeps. The first substep sweeps the grid in the x-direction one row at a time solving for the unknown hydraulic heads. The second substep sweeps the system in the y-direction one column at time solving for the unknown heads. The end of these two half-time steps arrives at the new value for head at a specific time level. The two-step process thus reduces the more complex two-dimensional problem to a succession of two one-dimensional processes.

After calculating the head distribution for a given time step, an explicit finite-difference method computes the velocity of groundwater flow at each node, one at a time. For example, the model computes the velocity in the x-direction at node (i, j) as

$$V_{x(i,j)} = \frac{K_{xx(i,j)}}{\epsilon} \frac{(h_{i-1,j,k} - h_{i+1,j,k})}{2\Delta x}. \tag{7}$$

The following equation describes the velocity in the x-direction on the boundary between node (i, j) and node (i+1, j):

$$V_{x(i+1/2,j)} = \frac{K_{xx(i+1/2,j)}}{\epsilon} \frac{(h_{i,j,k} - h_{i+1,j,k})}{\Delta x} \tag{8}$$

where it determines the hydraulic conductivity on the boundary as the harmonic mean of the hydraulic conductivities at the two adjacent nodes.

Expressions similar to the above velocity equations can compute the velocities in the y-direction at (i, j) and (i+1, j), respectively (Konikow, 1978).

Transport Equation

Method of Characteristics. This model uses the method of characteristics to solve the solute-transport equation. This method allows the solution of hyperbolic differential equations. The domination of solute-transport by advection, as is common in many field problems, leaves the transport equation closely approximating a hyperbolic particle differential equation that is highly compatible with the method of characteristics. Although it is difficult to present a rigorous mathematical proof for this numerical scheme, its success is verifiable in a variety of field problems. The solution obtained using the method of characteristics compares with those derived by analytical methods and agrees closely in the cases investigated.

The approach taken by the method of characteristics is not to solve the transport equation directly, but to solve an equivalent combination of ordinary differential equations. By considering saturated thickness as a variable and by expanding the convective transport term, the transport equation may be expressed as

$$\frac{\partial C}{\partial t} = \frac{1}{b}\frac{\partial}{\partial x_i}\left(bD_{ij}\frac{\partial C}{\partial x_j}\right) - V_i\frac{\partial C}{\partial x_i} + \frac{C\left(S\frac{\partial h}{\partial t} + W - \epsilon\frac{\partial b}{\partial t}\right) - C'W}{\epsilon b}. \tag{9}$$

Changes with time in characteristics of fluid convected by groundwater, such as concentration, may be described for reference fluid particles as they move along their particular paths past established points in space. dC/dt is the rate of change as observed when moving with the fluid particle.

The following equations describe the characteristic curves used to solve the transport equation

$$x=x(t);\; y=y(t);\; \text{and } C=C(t) \tag{10}$$

which are the solutions to the following system of equations:

$$\frac{dx}{dt} = V_x \tag{11}$$

$$\frac{dy}{dt} = V_y. \tag{12}$$

and

$$\frac{dC}{dt} = \frac{1}{b}\frac{\partial}{\partial x_i}\left(bD_{ij}\frac{\partial C}{\partial x_j}\right) + F \tag{13}$$

where

$$F = \frac{C\left(S\frac{\partial h}{\partial t} + W - \epsilon\frac{\partial b}{\partial t}\right) - C'W}{\epsilon b}. \tag{14}$$

The model solves the partial differential equation by following the characteristic curves. It does this numerically by tracing a set of moving points within the stationary coordinates of the finite-difference grid. Each point corresponds to one characteristic curve and MOC obtains values of x, y, and C as functions of time for each characteristic. Each point has a concentration and position associated with it as it moves through the flow field in proportion to the flow velocity at its location. Intuitively, the method may be visualized as tracing several fluid particles through a flow field and observing changes in chemical concentration in the fluid particles as they move (Konikow, 1978).

<u>Particle Tracking</u>. The method of characteristics involves placing from four to sixteen traceable particles or points in each cell of the finite-difference grid to form a regularly patterned distribution of points throughout the area of interest. For most two dimensional problems, this range of points produces satisfactory results. The x- and y- coordinates in the finite-difference grid allow tracking

of the particle locations. The initial concentration assigned to each point is the initial concentration associated with the node of the cell containing the point.

During each time step every particle moves a distance proportional to the length of the time increment and the velocity at the location of the particle, allowing the computation of the particle's new position.

After moving all particles, the average of the concentrations of all particles then located within the area of that cell determine the temporary concentration at each node. This temporary concentration represents the new time level only with respect to convective transport. The simulation of convective transport occurs because the concentration in each cell will change with each time step as different particles having various concentrations enter and leave it (Konikow, 1978).

Finite-Difference Approximations. The total change in concentration in an aquifer may be computed by solving Equations 11, 12, and 13. Equations 11 and 12 describe changes in concentration caused by convective transport alone that are solved by the movement of points as described previously. An explicit finite-difference approximation to Equation 13 describes other changes in concentration caused by hydrodynamic dispersion, fluid sources, divergence of velocity, and changes in saturated thickness that can be expressed as:

$$\Delta C_{i,j,k} = \Delta t\left[\frac{1}{b}\frac{\partial}{\partial x_i}\left(bD_{i,j}\frac{\partial C}{\partial x_j}\right) + F\right]. \tag{15}$$

Note that a solution to Equation 13 requires the computation of the change in concentration at the tracer particles. Primarily, because of the difficulty in computing the concentration gradient at a large array of moving points, Equation 13 describes the change in concentration at each node of the grid. The material derivative of concentration on any characteristic curve (or for any tracer particle) then relates to the change in concentration for a node during one time step, computed with the solution to Equation 15.

The change in concentration due to dispersion can be described by expanding the dispersion term from Equation 15 to

$$(\Delta C_{i,j,k})_I = \frac{\Delta t}{b}\left[\frac{\partial}{\partial x}\left(bD_{xx}\frac{\partial C}{\partial x} + bD_{xy}\frac{\partial C}{\partial y}\right) + \frac{\partial}{\partial y}\left(bD_{yy}\frac{\partial C}{\partial y} + bD_{yx}\frac{\partial C}{\partial x}\right)\right]. \tag{16}$$

By making the assumptions that concentrations are known for the previous time level and that the cell boundary concentration is approximately equal to the average of the concentrations at adjacent nodes, the finite-difference approximations for the derivatives in the x- and y-directions respectively are

$$\frac{\partial}{\partial x}\left(bD_{xx}\frac{\partial C}{\partial x} + bD_{xy}\frac{\partial C}{\partial y}\right) =$$

$$\frac{bD_{xx}[i+1/2,j](C_{i+1,j} - C_{i,j})}{(\Delta x)^2} - \frac{bD_{xx}[i-1/2,j](C_{i,j} - C_{i-1,j})}{(\Delta x)^2}$$

$$+ \frac{bD_{xy}[i+1/2,j](C_{i,j+1} + C_{i+1,j+1} - C_{i,j-1} - C_{i+1,j-1})}{4\Delta x \Delta y}$$

$$- \frac{bD_{xy}[i-1/2,j](C_{i-1,j+1} + C_{i,j+1} - C_{i-1,j-1} - C_{i,j-1})}{4\Delta x \Delta y}. \tag{17}$$

and

$$\frac{\partial}{\partial y}\left(bD_{yy}\frac{\partial C}{\partial y} + bD_{yx}\frac{\partial C}{\partial x}\right) =$$

$$\frac{bD_{yy}[i,j+1/2](C_{i,j+1} - C_{i,j})}{(\Delta y)^2} - \frac{bD_{yy}[i,j-1/2](C_{i,j} - C_{i,j-1})}{(\Delta y)^2}$$

$$+ \frac{bD_{yx}[i,j+1/2](C_{i+1,j} + C_{i+1,j+1} - C_{i-1,j} - C_{i-1,j+1})}{4\Delta x \Delta y}$$

$$- \frac{bD_{yx}[i,j-1/2](C_{i+1,j-1} + C_{i+1,j} - C_{i-1,j-1} - C_{i-1,j})}{4\Delta x \Delta y}. \tag{18}$$

Equation 16 may be solved explicitly by substituting the relationships expressed by Equations 17 and 18 into the bracketed terms of Equation 16.

The change in concentration due to an external fluid source or sink can be defined from Equation 15 as

$$(\Delta C_{i,j,k})_{II} = \Delta t F = \Delta t \left[\frac{C\left(S\frac{\partial h}{\partial t} + W - \epsilon\frac{\partial b}{\partial t}\right) - C'W}{\epsilon b}\right]. \tag{19}$$

Substituting explicit finite-difference approximations for the terms in Equation 19, we get

$$(\Delta C_{i,j,k})_{II} =$$

$$\frac{\Delta t}{\epsilon b_{i,j,k}}\left[C_{i,j,k-1}\left(S\left[\frac{h_{i,j,k} - h_{i,j,k-1}}{\Delta t}\right] + W_{i,j,k} - \epsilon\left[\frac{b_{i,j,k} - b_{i,j,k-1}}{\Delta t}\right]\right)\right.$$

$$\left. - C'_{i,j,k}W_{i,j,k}\right]. \tag{20}$$

By substituting the approximations from Equations 17, 18 and 20 into Equation 15, a solution can be arrived at and the characteristic curves of Equation 9 defined.

The finite-difference approximation to Equation 15 can be further refined to

$$\Delta C_{i,j,k} = \frac{0.5\Delta t}{b}\left[\frac{\partial}{\partial x_i}\left(bD_{i,j}\frac{\partial C_{(k-1)}}{\partial x_j}\right) + \frac{C_{(k-1)}\left(S\frac{\partial h}{\partial t} + W - \epsilon\frac{\partial b}{\partial t}\right) - C'W}{\epsilon}\right]$$
$$+ \frac{0.5\Delta t}{b}\left[\frac{\partial}{\partial x_i}\left(bD_{i,j}\frac{\partial C_{(k^*)}}{\partial x_j}\right) + \frac{C_{(k^*)}\left(S\frac{\partial h}{\partial t} + W - \epsilon\frac{\partial b}{\partial t}\right) - C'W}{\epsilon}\right] \quad (21)$$

which describes a two-step explicit procedure used to minimize the limitations imposed by estimating nodal concentrations in a strict explicit manner.

The computations for the new nodal concentrations at the end of a time increment are

$$C_{i,j,k} = C_{i,j,k^*} + \Delta C_{i,j,k} \quad (21)$$

where C_{i,j,k^*} is the average of the concentration of the points in cell (i, j) after the solution of particle tracking for the time step and $\Delta C_{i,j,k}$ is the change in concentration caused by hydrodynamic dispersion, sources, and sinks as calculated in Equation 21.

The change in concentration computed at a node using Equation 21 cannot be applied directly in all cases to the concentration of the points in a cell because if the concentration change at a node is negative, it must be applied to points in that cell as a percentage decrease in concentration at each point (as opposed to simply adding an increase to the point concentrations for a positive change) that is equal to the percentage decrease at the node in order to preserve a mass balance within each cell, and prevent a possible but erroneous computation of negative concentrations at those points that had a concentration less than that at the node (Konikow, 1978).

Stability Criteria. The explicit numerical solution of the solute-transport equation has several stability criteria associated with it. These may require the subdivision of the time step used to solve the flow equation be into several smaller time increments to solve the solute-transport equation.

For the dispersion term in Equation 13 to be stable

$$\Delta t \leq \underset{\text{(over grid)}}{\text{Min}} \left[\frac{0.5}{\frac{D_{xx}}{(\Delta x)^2} + \frac{D_{yy}}{(\Delta y)^2}} \right]. \tag{23}$$

The stability criteria for the source term require that

$$\Delta t \leq \underset{\text{(over grid)}}{\text{Min}} \left[\frac{\epsilon b_{i,j,k}}{W_{i,j,k}} \right]. \tag{24}$$

The third type of stability check involves the movement of points in the simulation of convective transport. This check requires that

$$\Delta t \leq \frac{\gamma \Delta x}{(V_x)_{max}} \tag{25}$$

and

$$\Delta t \leq \frac{\gamma \Delta y}{(V_y)_{max}} \tag{26}$$

where

γ is the fraction of the grid dimension that particles will be allowed to move.

This eliminates the possibility that a particle might move beyond the boundaries of the grid during one time increment.

If the time step used to solve the flow equation exceeds the smallest of the time limitations established by Equations 23 through 26, then the time step will be subdivided into the appropriate number of smaller time increments to solve the transport equation (Konikow, 1978).

Boundary and Initial Conditions. The designation of boundary and initial conditions for the domain of a solute-transport problem is a prerequisite for obtaining a solution to the equations that describe groundwater flow and solute transport. The conditions specified for solving the flow equation must be compatible with the solution for the solute-transport equation. The two general types included in this model are constant-flux and constant-head conditions. These can be used to depict the real boundaries of an aquifer and to represent artificial boundaries for the model. The use of artificial boundaries can help to minimize data requirements and the areal extent of the modeled part of the aquifer.

A constant-flux boundary represents aquifer underflow, and pumping or injection wells. The specification of the flux rate as a well pumping or injection rate for the appropriate nodes designates a finite flux. The numerical procedure used in this model requires the surrounding of the area of interest by a no-flow boundary that is a special case of a constant-flux boundary. Thus the model will automatically specify the outer rows and columns of the finite-difference grid as no-flow boundaries by setting the transmissivity equal to zero at the appropriate nodes, preventing the flow of water or dissolved chemicals across the boundaries of the cell containing that node.

The use of a constant-head boundary in the model accounts for parts of the aquifer where the head will not change with time, such as recharge boundaries or areas out of the influence of hydraulic stresses. The rate of leakage into or out of the designated constant-head cell would equal the flux required to sustain the head in the aquifer at the specified constant-head elevation.

At constant-flux or constant-head boundaries the concentration of the fluid source must be specified. The concentration in the outflow at a fluid sink will equal the concentration in the aquifer at that point.

The initial conditions for solute transport must be specified. Hydraulic and concentration gradients, the head and concentration in the aquifer at the start of the simulation period can be determined from field data and from previous simulations. It is important to note that the simulation results may be sensitive to variations or errors in the initial conditions (Konikow, 1978).

Mass Balance. The performance of mass balance checks after each time step helps check the numerical accuracy of the solution. The principle of conservation of mass requires that the net flux must equal the accumulation of mass (or change in mass stored). The net flux minus the mass accumulation is the mass residual (R_m) and is one measure of the numerical accuracy of the solution. A small residual does not prove the accuracy of the solution but, a large error in the mass balance in undesirable and may indicate the presence of a critical error in the numerical solution.

MOC uses two methods to estimate the error in the mass balance, both based on the measure of the mass residual, R_m, computed from

$$R_m = \Delta M_s - M_f \tag{27}$$

where

ΔM_s	is the change in mass stored in the aquifer, M; and
M_f	is the net mass flux, M.

First, the comparison of the residual with the average of the net flux and net accumulation determines the percent error (E) in the mass balance,

$$E_1 = \frac{100.0\,(M_f - \Delta M_s)}{0.5\,(M_f + \Delta M_s)}. \tag{28}$$

This is a good measure of the accuracy of the numerical solution when the flux and the change in mass stored are relatively large. However, Equation 28 does not account for the initial mass of solute in the aquifer. If total fluxes are very small compared to the initial mass of solute in the aquifer, then Equation 28 might indicate a relatively large error when the numerical solution is accurate. A second way of computing the error is by comparing the residual with the initial mass of solute (M_o) present in the aquifer as

$$E_2 = \frac{100.0\,(M_f - \Delta M_s)}{M_o}. \tag{29}$$

Equation 29 provides a good degree of the accuracy of the numerical solution when fluxes approach zero. When M_f is zero or very small in comparison to ΔM_s, then E_2 becomes meaningless. This problem can be overcome by correcting M_o in the denominator of Equation 29 for the net mass flux, resulting in

$$E_3 = \frac{100.0\,(M_f - \Delta M_s)}{M_o - M_f}. \tag{30}$$

Note that as M_f approaches zero, Equation 29 approaches Equation 30, and as M_o approaches zero, E_3 becomes just a comparison of the residual with the net flux. In the latter case E_2 is a mass balance indicator similar to E_1 in Equation 28. Thus E_3 is considered a more reliable and versatile indicator of numerical accuracy than is E_2. The model computes either one or both of E_1 and E_3 as appropriate (Konikow, 1978).

Special Problems. The use of the method of characteristics to solve the solute-transport equation has several special problems associated with it. The more significant problems associated with the movement and tracking of particles, and the computational transition between the concentrations of particles within a cell and the average concentration at that node will be addressed in this section with the procedures used to minimize errors that might result from them.

One potential problem is the convection of a particle across a no-flow boundary due to the interpolated velocity at that particle location during one time increment. After the advection of a particle is across a no-flow boundary, the model relocates it within the aquifer by reflection across the boundary, thus putting the relocated particle closer to the true flow line.

Fluid sources and sinks require special treatment because they tend to represent singularities in the velocity field. The use of a central difference formulation to compute the velocity at a node may indicate zero or very small velocities at the nodes, precluding the use of the velocity components at a source or sink node for interpolation of the velocity at a point within or adjacent to that cell. To help maintain radial flow to or from a sink or source, respectively, the velocities computed on the boundaries of source or sink cells are assigned to that node. MOC determines the applicable boundary velocities on the basis of the quadrant of interest. The model makes corresponding adjustments for points in other quadrants, so that the magnitude and direction of velocity at the node are not fixed for a given time increment, but depend on the relative location of the point of interest within the cell. MOC makes a similar approximation when a point of interest is in a cell adjacent to a source or sink.

Special care is necessary in areas where sources and sinks dominate the flow field. Because points continually move out of source cells with few or none moving in to replace them, whenever a point that originated in a source cell moves out, another point moves in to replace it. Placement of new points in a source cell is compatible with and comparable to the generation of fluid and solute mass at the source.

The procedure used to replace points in source cells that are adjacent to no-flow boundaries is a steady, uniformly spaced stream of points, maintained by generating a new point at the same relative position in the source cell as the new position in the adjacent cell of the point that left the source cell.

The procedure use to replace points in source cell that lie within the aquifer and not adjacent to a no-flow boundary is a steady, uniformly spaced stream of particles maintained by generating a new point in the source cell at the original location of the point that left the source cell. With a relatively strong source directed into a relatively weak regional flow field, radial flow will be maintained in the area of the source, and all initial and replacement points will move symmetrical away from the node. In the case of a relatively weak source in a relatively strong regional flow field the velocity distribution within the source cell does not possess radial symmetry, and the velocity within the upgradient part of the source cell is much lower than the velocity within the downgradient part of the source cell. Replacement of points at the original location in source cells will maintain a steady stream of points leaving the source cell in proportion to the velocity field. The use of the procedure described above for a source adjacent to a no-flow boundary would result in the accumulation of points in the low-velocity area of the source cell with few points being replaced into the high-velocity area, where convective transport is the greatest.

The convection of points out of a source cell is usual, but the possibility exists that points may sometimes enter a source cell. This can occur when two or more source cells of different strengths are near to each other. An erroneous multiplication of points might result if the replacement of points that did not originate in a particular source cell occurs at the time of their convection out of that source cell. Therefore, MOC replaces points leaving a source cell only if they originated in that source cell.

In the case of hydraulic sinks, points continuously move into a cell representing a strong sink, but few or none move out. To avoid the subsequent crowding and stagnation of tracer points, the model removes from the flow field any point moving into a sink cell after the completion of the calculations for that time step. The numerical withdrawal of points that enter sink cells is comparable to the withdrawal of fluid and solute mass through the hydraulic sink. The combination of producing new points at sources and destroying old points at sinks tends to maintain the total number of points in the flow field at a near constant value.

A problem can arise in areas of divergent flow because some cells may become void of points where flowlines become spaced widely apart. This results in a calculation of "no change" in concentration at a node due to advection, although MOC adjusts the nodal concentration for changes caused by hydrodynamic dispersion. Also, the generation of some numerical dispersion occurs at nodes in and adjacent to cells where there was underestimation of the advection of solute because of the resulting error in the concentration gradient. This might not cause a serious problem if only a few cells in a large grid became void or if the voiding were transitory (that is, if the convection of upgradient points into void cells occurs during succeeding time increments). Radial flow represents the most extreme case of divergent flow. It shows that when using four points per cell to simulate convective transport, then in the numerical operation, four of the eight surrounding cells erroneously do not take in any solute by convection from the adjacent source. With the use of eight points per cell initially, at a distance of two rows or columns from the source, only 8 of 16 cells are on flowlines originating in the source cell. So increasing the initial number of points per cell helps, but obviously, purely radial flow requires an impractically large initial number of points per cell to be certain that at least one particle flowline passes from the source through every cell in the grid.

The problem of cells becoming void of particles can be minimized by restricting the number of empty cells that represent the aquifer. If the numerical solution to the solute-transport equation exceeds this limit, then the solution terminates at the end of that time step and saves the "final" concentrations at that time. The problem then reinitiates at the time of termination by regenerating the initial particle distribution throughout the grid and assigning the "final" concentrations at the time of termination as new "initial" concentrations for nodes and particles. The solution to the solute-transport equation then simply continues in time from this new set of "initial" conditions until the total simulation period has elapsed. This procedure preserves the mass balance within each cell but also introduces a small about of numerical dispersion by eliminating variations in concentration within individual cells.

The program includes an optimization routine to help minimize the numerical dissemination resulting from the regeneration of points. It attempts to maintain an approximation of the previous concentration gradient within a cell by meeting the following constraints:

$$\frac{\sum_{n=1}^{N_p} C_n^*}{N_p} = C_{i,j} \tag{31}$$

$$C_{ij} \leq C_n^* \leq C_{l,m} \quad \text{for } C_{ij} \leq C_{l,m} \tag{32}$$

and

$$C_{l,m} \leq C_n^* \leq C_{ij} \quad \text{for } C_{ij} \geq C_{l,m} \tag{33}$$

where

C_n^*	is the concentration of the nth point in cell (i, j), M/L^3;
N_p	is the total number of points initially placed in a cell; and
$C_{l,m}$	is the concentration at node (l, m), which represents a cell adjacent to (i, j) and on a line that starts at (i, j) and extends through the coordinates of the point (n) of interest, M/L^3.

Note that Equation 31 simply indicates that a mass balance must be preserved in a cell regardless of the range in variation of point concentration within the cell. Equations 32 and 33 indicate that the concentration of any point must lie between C_{ij} and the concentration at the node adjacent to particle n. The coordinates of the adjacent node would take on values of l=i or m=j. The optimization routine, to avoid computational delay, sets all C_n^* equal to C_{ij} if Equations 31 through 33 cannot be satisfied simultaneously for node (i, j) with two iterations (Konikow, 1978).

Adsorption

In 1989 The U.S. Geological Survey computer model of two-dimensional solute transport and dispersion in groundwater was modified to include the following types of chemical reactions: 1) fist-order irreversible rate-reaction, such as radioactive decay; 2) reversible equilibrium-controlled sorption with linear, Freundlich or Langmuir isotherms; and 3) reversible equilibrium-controlled ion exchange for monovalent or divalent ions. Konikow and Goode (1989) developed procedures to incorporate these processes in the general solution scheme that uses method of characteristics with particle tracking for advection and finite-difference methods for dispersion. The first type of reaction is accounted for by an exponential decay term applied directly to the particle concentration (Goode, 1989).

$$t1/2 = (\ln 2)/\lambda \qquad (34)$$

where

λ is the decay constant, T^{-1}.

The second and third types of reaction are incorporated through a retardation factor, which is a function of concentration for nonlinear cases.

$$Rf = 1+(\rho_b Kd/\epsilon) \qquad (35)$$

$$Rf(C) = 1+(\rho_b/\epsilon)dC/dC \qquad (36)$$

where

Rf	is the retardation factor, dimensionless, and
ρ_b	is the bulk density, M/L^3.

The model is evaluated and verified by comparison with analytical solutions and to results from the model of Grove and Stollenwerk (1984) for one-dimensional problems. Two-dimensional results are compared to results from the SUTRA (Saturated Unsaturated TRAnsport) model (Voss, 1984).

CHAPTER IV

APPLYING USGSMOC TO THE EMERSON ELECTRIC SITE

Creating the Model

This portion of Chapter IV will walk through the preprocessor, PREMOC, which was used in building the model for the Emerson Electric site.

Title

The first card of PREMOC asks for a title for the problem. In this case the title given was "Emerson Electric--Altamonte Springs, Florida."

Control Card I

NTIM: Maximum Number of Time Steps in a Pumping Period. A number between 1 and 100 can be assigned for the number of time steps in the pumping period. For a steady state problem such as this one the total pumping period is divided into the designated number of time steps, each being of equal length. Thirty was the number selected for this problem.

NPMP: Number of Pumping Periods. Numerous sequential pumping periods may be modeled within each problem. For Emerson Electric, two pumping periods were modeled: 1) the time period that the recovery pumps were running from December 1984 until June 1987, or 2.5 years; and 2) the time period between June 1987, when the recovery wells were stopped, and May of 1988, the last sampling event, or 0.9 years.

NX: Number of Nodes in the X-Direction. The map of the area being modeled must be subdivided into smaller nodes. The limit for the flow model is 40 nodes in each direction and the limit for transport is 20 nodes in each direction. The Emerson Electric site was divided into 16 nodes in the x-direction.

NY: Number of Nodes in the Y-Direction. The y-direction for Emerson Electric was divided into 20 nodes.

NPMAX: Maximum Number of Particles. This variable designates the maximum number of particles allowed in the finite-difference grid. For accuracy, 16 particles will be designated for each cell and since there are 16 x 20 or 320 cells, that comes to a total of 5120 particles, rounded up to 5200 and entered as NPMAX.

NPNT: Number of Time Steps Between Printouts. For this problem, only the results at the end of each pumping period were of interest, so 30 time steps were designated between printouts.

NITP: Number of Iteration Parameters. Between four and ten iteration parameters may be specified for an ADIP problem. Seven was the number used for this problem.

NUMOBS: Number of Observation Points. A maximum of five observation points may be designated. For this problem five were designated, one for each extraction well.

ITMAX: Number of Iterations in ADIP. Between 100 and 200 iterations may be specified for ADIP. The Emerson Electric problem uses 150 for the first pumping period.

NREC: Number of Pumping or Injection Wells to be Specified. Since there were five extraction wells at the Emerson Electric site, five was entered here.

NPTPND: Initial Number of Particles per Node. Since the first step in the method of characteristics involves placing a number of traceable particles in each cell of the finite-difference grid, that number must be entered here. It may be 1,4,5,8,9 or 16. The higher the number, the higher the degree of accuracy. As mentioned above, 16 was used for this problem.

NCODES: Number of Node Identification Codes. This number, a maximum of ten, allows those nodes with special properties such as constant head or constant flux to be specified. For the Emerson Electric model, constant head boundaries were designated on two sides of the finite-difference grid. This was the only node identification code used, so the number entered here was one.

NPNTMV: Particle Movement Interval for Printing Chemical Data. The zero entered here determined that chemical data would be printed at the end of the simulation only.

NPNTVL: Option for Printing Computed Velocities. The zero entered here determined that for this problem velocities would not be printed.

NPNTD: Option for Printing Computed Dispersion Coefficients. The zero entered here determined that for this problem dispersion coefficients would not be printed.

NPDELC: Should Changes in Concentration be Printed. A zero entered here determined that for this problem changes in concentration would not be printed.

NPDELC: Option to Write Velocity Data. A zero was entered here as for NPNTVL.

IREACT: Should Retardation and Radioactive Decay be Included? Nine choices are available for this option: 1) a -1 designates decay only; 2) a 0 designates no reaction; 3) a 1 designates linear sorption with or without decay; 4) a 2 designates Freundlich sorption with or without decay; 5) a 3 designates Langmuir sorption with or without decay; 6) a 4 designates monovalent exchange with or without decay; 7) a 5 designates divalent sorption with or without decay; 8) a 6 designates mono-divalent exchange with or without decay; and 9) a 7 designates di-monovalent exchange with or without decay. A one was entered here since linear sorption was used to describe the sorption characteristics of the Emerson Electric site aquifer, due to the fact that there were no adsorption data with which to determine the actual isotherms.

Control Card IIb

DK: Distribution Coefficient. This is where the soil distribution coefficient (Kd) of the contaminant in the aquifer material is entered. For linear sorption it can be described in terms of the fraction organic carbon of the soil (foc) and the organic carbon distribution coefficient (Koc). Kd = Koc x foc (ESE, 1984). This is one of the parameters that was varied in order to calibrate the model. The different values and how they were arrived at will be discussed later.

RHOB: Bulk Density of the Solid. The bulk density for a matrix of moderately sorted fine sand is 1.96 gr/cm3 (Lindbergh, 1989), however, ESE, in their calculations used 2.65 gr/cm3 which is the particle density (ESE, 1984). The bulk density of the matrix is what is required to accurately determine the retardance of the contaminant.

THALF: Half-Life of the Solute. Zero is entered here for this problem since decay is not being considered.

Control Card II

PINT: Pumping Period in Years. This refers to the first pumping period which, as discussed above, ran from December 1984 to June 1987, or two and a half years.

TOL: Convergence Criteria in ADIP. This problem was required to converge within 0.01.

POROS: Effective Porosity. The porosity for the soil at Emerson Electric was 0.35 as determined from the literature and is a good value for moderately sorted fine sands (ESE, 1984).

BETA: Characteristic Length (Longitudinal Dispersivity). This is another parameter that was varied in the calibration of the model. The range used was from 11 feet to 100 feet.

S: Storage Coefficient. This model was run as a steady state model, therefore this parameter was set equal to zero.

TIMX: Time Incrementx Multiplier. This variable is not required for a steady state simulation.

TINIT: Initial Time. This variable is not required for a steady state simulation.

XDEL: Width of Finite-Difference Cell in X-Direction. The site map was divided up into cells, each 25 feet in width.

YDEL: Width of Finite-Difference Cell in Y-Direction. The cell width in the y-direction was also 25 feet.

DLTRAT: Ratio of Transverse to Longitudinal Dispersivity. A ratio of 0.5 was used for this model.

CELDIS: Maximum Cell Distance per Particle Move. The maximum distance a particle was allowed to move in each move was one half of one cell.

ANFCTR: Ratio of Tyy to Txx. This indicates that the vertical transmissivity of the Emerson aquifer is the same as the horizontal transmissivity. This is an assumption made for the purpose of this model.

Data Set 1: Observation Points

The observation points were set at the same nodes as the pumping wells because the site was monitored by taking composite samples from the extraction wells. The nodes set as observation wells are: (5,12), (5,16), (5,17), (4,17), and (4,14).

Data Set 2: Wells

The pumping wells were located at the nodes mentioned in the description of Data Set 1 which correspond to their location on the site map (Fig. 3) and the pumping rates were set at 0.13e-1 cubic feet per second (cfs) which is equal to six gpm as stated in the literature (ESE, 1984).

TABLE II

GRID LOCATION OF PUMPING WELLS

Well No.	X	Y
1	5	12
2	5	16
3	5	17
4	4	17
4	4	14

Data Set 3: Transmissivity

This is another of the parameters that was varied in the calibration process for the Emerson model. The hydraulic conductivity of the aquifer was determined from a series of slug tests. The average value for the shallow wells using the Bouwer and Rice solution is 2.35e-5 feet per second (fps) and the average value using the Hvorslev method is 4.67e-5 fps (ESE, 1982). These were multiplied by the 50 foot aquifer thickness (ESE, 1982) to obtain the average transmissivities of 1.175e-3 square feet per second (sf/s) and 2.335e-3 sf/s.

Data Set 4: Aquifer Thickness

As mentioned above, the thickness of the upper aquifer at the Emerson Electric site is 50 feet.

Data Set 5: Recharge/Discharge

For the purposes of this model, and since there were no sources of recharge other than rainfall, this was set to zero.

Data Set 6: Node Identification Matrix

Node along the upper and lower boundaries of the finite-difference grid were set equal to 1 for the purpose of creating a constant head boundary.

Data Set 7: Instructions for Node ID's

The FCTR1 which indicates leakance was set equal to 1 in order to maintain a constant head on two of the grid boundaries.

Data Set 8: Initial Head

The initial heads were entered for the constant head nodes. They were determined from the water table map (ESE, 1982) (Figure 5).

Data Set 9: Initial Concentration

Two different plumes were modeled during the calibration process. Since the only contour of the contaminant plume given in the literature was 500 ppm total VOCs, some assumptions were required. For the larger plume modeled, the assumption was made that a constant contamination gradient ran between ES3 and ES4 because, although the extent of the contamination at ES3 was not nearly as great as ES4, it had slightly elevated levels of many contaminants. The smaller plume modeled, was simply the 500 ppm contour with the adjacent nodes labeled as a 100 ppm contour and the nodes directly outside of that labeled as a 1 ppm contour. Since ESE describes the plume as being limited in areal extent and since each grid square is 25 feet by 25 feet, this smaller plume is a reasonable estimate by this author of the closest possible location of the limits of the plume to ES4.

Data Set 10: Additional Pumping Periods

The control parameters for the second pumping period were the same as for the first except for the number of iterations in ADIP which changed to 100, the length of the pumping period which was 0.9 years and there were no extraction wells operating during the second pumping period.

Calibration of the Model

The model was put through 47 calibration runs varying the hydraulic conductivity, the longitudinal dispersivity, the size of the plume beyond the 500 ppm contour, as described previously, and the linear distribution coefficient, in order to find an acceptable match for the results determined in the field by ESE. All of the parameters varied were ones not definitively defined by the work of ESE. The criteria used to determine an acceptable match were the results of the composite sampling events at the end of Pumping Period 1 and the composite results at the end of Pumping Period 2. Those results were <25 ppb in June of 1987 and <80 ppb in May of 1988 (EPA, 1989). The results of the calibration runs may be found in Table III.

The transmissivity was varied using the average of the hydraulic conductivities of all four shallow wells as determined by the Bouwer and Rice method, 2.35e-5 fps and the average of the conductivities as determined by the Hvorslev method, 4.67e-5 fps. It was found that varying the transmissivity calculated using these two numbers made very little difference in the results. It was also noted that the smaller Kd was, the closer the composite results were at the two different hydraulic conductivities, all else being the same.

Longitudinal dispersivity was varied between 100 ft., 50 ft., and 20 ft., for most runs. As the iterations came

TABLE III

CALIBRATION RUNS

FILE NAME	HYD. COND. (FPS)	DISPER-SIVITY (FT)	PLUME SIZE	Kd	COMP. CONC. 6/87 (PPM)	COMP. CONC. 5/88 (PPM)	Foc
EMRSN1.IN	2.35E-05	100.0	LARGE	0.6000	21.400	27.800	0.2%
EMRSN2.IN	2.35E-05	50.0	LARGE	0.6000	19.600	20.700	0.2%
EMRSN3.IN	2.35E-05	20.0	LARGE	0.6000	16.400	17.000	0.2%
EMRSN4.IN	4.67E-05	100.0	LARGE	0.6000	21.800	22.800	0.2%
EMRSN5.IN	4.67E-05	50.0	LARGE	0.6000	19.800	21.600	0.2%
EMRSN6.IN	4.67E-05	20.0	LARGE	0.6000	16.400	17.300	0.2%
EMRSN7.IN	2.35E-05	100.0	LARGE	0.1350	4.900	5.380	0.2%
EMRSN8.IN	2.35E-05	50.0	LARGE	0.1350	3.400	3.820	0.2%
EMRSN9.IN	2.35E-05	20.0	LARGE	0.1350	1.400	1.520	0.2%
EMRSN10.IN	4.67E-05	100.0	LARGE	0.1350	4.960	5.780	0.2%
EMRSN11.IN	4.67E-05	50.0	LARGE	0.1350	3.380	4.120	0.2%
EMRSN12.IN	4.67E-05	20.0	LARGE	0.1350	1.340	1.680	0.2%
EMRSN13.IN	2.35E-05	100.0	LARGE	0.0675	3.140	3.640	0.1%
EMRSN14.IN	2.35E-05	50.0	LARGE	0.0675	1.900	2.220	0.1%
EMRSN15.IN	2.35E-05	20.0	LARGE	0.0675	0.580	0.660	0.1%
EMRSN16.IN	4.67E-05	100.0	LARGE	0.0675	3.180	3.840	0.1%
EMRSN17.IN	4.67E-05	50.0	LARGE	0.0675	1.860	2.380	0.1%
EMRSN18.IN	4.67E-05	20.0	LARGE	0.0675	0.560	0.680	0.1%
EMRSN19.IN	2.35E-05	100.0	SMALL	0.6000	14.800	15.500	0.2%
EMRSN20.IN	2.35E-05	50.0	SMALL	0.6000	12.700	13.300	0.2%
EMRSN21.IN	2.35E-05	20.0	SMALL	0.6000	7.920	8.280	0.2%
EMRSN22.IN	4.67E-05	100.0	SMALL	0.6000	15.100	15.800	0.2%

TABLE III (Continued)

FILE NAME	HYD. COND. (FPS)	DISPER-SIVITY (FT)	PLUME SIZE	Kd	COMP. CONC. 6/87 (PPM)	COMP. CONC. 5/88 (PPM)	Foc
EMRSN23.IN	4.67E-05	50.0	SMALL	0.6000	12.700	13.800	0.2%
EMRSN24.IN	4.67E-05	20.0	SMALL	0.6000	8.360	8.840	0.2%
EMRSN25.IN	2.35E-05	100.0	SMALL	0.3000	6.760	7.160	0.1%
EMRSN26.IN	2.35E-05	50.0	SMALL	0.3000	5.140	5.580	0.1%
EMRSN27.IN	2.35E-05	20.0	SMALL	0.3000	2.420	2.560	0.1%
EMRSN28.IN	4.67E-05	100.0	SMALL	0.3000	6.900	7.580	0.1%
EMRSN29.IN	4.67E-05	50.0	SMALL	0.3000	5.320	6.060	0.1%
EMRSN30.IN	4.67E-05	20.0	SMALL	0.3000	2.440	2.820	0.1%
EMRSN31.IN	2.35E-05	100.0	SMALL	0.1350	3.120	3.400	0.2%
EMRSN32.IN	2.35E-05	50.0	SMALL	0.1350	1.920	2.140	0.2%
EMRSN33.IN	2.35E-05	20.0	SMALL	0.1350	0.480	0.680	0.2%
EMRSN34.IN	4.67E-05	100.0	SMALL	0.1350	3.140	3.660	0.2%
EMRSN35.IN	4.67E-05	50.0	SMALL	0.1350	1.940	2.340	0.2%
EMRSN36.IN	4.67E-05	20.0	SMALL	0.1350	0.600	0.720	0.2%
EMRSN37.IN	2.35E-05	100.0	SMALL	0.0675	1.920	2.240	0.1%
EMRSN38.IN	2.35E-05	50.0	SMALL	0.0675	1.040	1.220	0.1%
EMRSN39.IN	2.35E-05	20.0	SMALL	0.0675	0.240	0.280	0.1%
EMRSN40.IN	4.67E-05	20.0	SMALL	0.0675	0.240	0.260	0.1%
EMRSN41.IN	4.67E-05	15.0	SMALL	0.0675	0.140	0.140	0.1%
EMRSN42.IN	4.67E-05	12.0	SMALL	0.0675	0.080	0.075	0.1%
EMRSN43.IN	4.67E-05	12.0	SMALL	0.0650	0.080	0.080	0.1%
EMRSN44.IN	4.67E-05	12.0	SMALL	0.0625	0.060	0.080	0.1%
EMRSN45.IN	4.67E-05	11.0	SMALL	0.0625	0.040	0.040	0.1%

TABLE III (Continued)

FILE NAME	HYD. COND. (FPS)	DISPER-SIVITY (FT)	PLUME SIZE	Kd	COMP. CONC. 6/87 (PPM)	COMP. CONC. 5/88 (PPM)	Foc
EMRSN46.IN	2.35E-05	11.0	SMALL	0.0625	0.060	0.040	0.1%
EMRSN47.IN	2.35E-05	11.0	SMALL	0.0600	0.060	0.040	0.1%

closer to the actual field results, the longitudinal dispersivity was changed to values lower than 20 ft. For the run that most closely approximated the conditions at Emerson Electric, 11 ft. was the dispersivity used. This is an unusually low longitudinal dispersivity but it can be justified by the fact that this shallow aquifer consists mostly of very fine to fine sands and gravel (EPA, 1989) and the percentage of silts and clays, which would provide the matrix heterogeneity for a high longitudinal dispersivity is less than 10 percent.

The plumes were varied between the large plume and the small plume as described above. The simulation was never able to match the field results using the larger plume, no matter how the other variables were manipulated. Since this site is fairly homogeneous and the longitudinal dispersivity appears to be small, it would follow that the dispersion of the plume has been minimized by these factors which aided in the timely remediation.

The distribution coefficient was the last parameter which was varied. The first few iterations assumed an foc of 0.2 percent as a starting point and the Koc of toluene, 300 ml/g (EPA, 1990), one of the most recalcitrant of the contaminants present, was used to calculate the Kd of 0.6. The simulated composite concentrations at the end of the pumping periods were orders of magnitude higher than those seen in the field. The Koc was then reduced to that of MIBK, 67.5 ml/g, the most prevalent of the contaminants present. This Koc was determined by back-calculating the Koc based on the Kd determined by ESE (ESE, 1984). Knowing the Koc for MEK and knowing that the Kd determined by ESE was 15 times higher at the same foc indicates that the Koc for MIBK is 15 times higher than that of MEK and a Kd of 0.135 was calculated for the given foc. These numbers were still produced composite concentrations that were orders of magnitude too high. Next, the foc was reduced to 0.1 percent and the Kds calculated for toluene and MIBK were 0.3 and 0.0675 respectively, both producing results still too high for a good calibration. The final Kd which produced acceptable results was 0.0600 which would correspond to the Koc of MIBK with an foc of 0.09 percent. This is consistent with the ESE testing which found the organic carbon content of the shallow aquifer materials was less that 0.1 percent in many of the samples tested (ESE, 1984).

One limitation of the model was its inability to report numbers less than 0.1 ppm at the observation points. The composite concentrations for the model were determined by taking the average of the five concentrations at the observation points. The calibration which was accepted, EMRSN45.IN, (shown in bold in Table III) showed two observation points with concentrations of 0.1 ppm VOCs and three points with concentrations of 0 ppm at the end of the pumping period. This was averaged, or taken as a composite, to be 40 ppb. The actual composite determined by ESE at the end of pumping was less 25 ppb. Since this was the closest calibration run to the actual field results and since the limits of MOC did not allow the reporting of concentrations less than 100 ppb, this run was accepted as a good calibration.

Error could have been introduced by the size of the grid squares. Each 25 foot by 25 foot square is assigned a concentration which is constant across the entire node. This probably does not reflect field conditions and can cause the model to over or underestimate the amount of chemical mass present in the aquifer.

Predicting the Clean-Up Time

The final step in modeling the Emerson Electric site was to ascertain how much longer the aquifer would have to be pumped to take the contamination to non-detect in each of the wells.

The calibrated model was used for this determination and all the variables for Pumping Period 1 were left unchanged. Pumping Period 2 was modified to include the five recovery wells pumping at 6 gpm each and the length of the pumping period was extended to one year. One printout was made after each time step for 30 time steps. This enabled a close determination of the time that it took for each of the observation points to consistently read zero ppm. The time required to do this was a total of 3.4 years, or only 0.9 years longer than the aquifer was actually pumped. The input and output files for this run may be found in Appendices A and B, respectively.

CHAPTER V

CONCLUSIONS

This chapter addresses the conclusions drawn by the EPA study of pump-and-treat systems as they pertain to the Emerson Electric site.

The characterization performed by ESE, could have been more thorough. Phase I included a thorough literature review, Phase II was a geophysical survey, including an EM survey and Phase III, the groundwater survey included installing and monitoring six wells. Phase IV, the soil sampling focussed on chromium contamination and would have been more thorough had it been broadened to include the VOCs found in the groundwater.

The site characterization could have been improved upon with additional borings to clearly define the plume. Overall, however the site assessment was adequate for this site.

The conclusion that hydraulic control of the plume was maintained cannot be proved for the Emerson Electric site. There was never an interception trench installed downgradient of the plume and the cone of influence of the wells was assumed to be adequate even though the water table was never measured during pumping. Some downgradient monitoring should have been provided at this site.

A substantial mass of contaminant was removed from the Emerson site, as it was modeled. The chemical mass for the site after 2.5 years of pumping was reduced from around 113 kilograms to around 62 grams. This can be seen in the chemical mass balance (Fig. 8) as determined by USGSMOC.

```
CHEMICAL MASS BALANCE

        MASS IN BOUNDARIES      =    .00000E+00
        MASS OUT BOUNDARIES     =    .00000E+00
        MASS PUMPED IN          =    .00000E+00
        MASS PUMPED OUT         =  -.10464E+09
        MASS LOST BY DECAY      =    .00000E+00
        MASS ADSORBED ON SOLIDS=    .16301E+05
        INITIAL MASS ADSORBED   =    .29182E+08
        INFLOW MINUS OUTFLOW    =  -.10464E+09
        INITIAL MASS DISSOLVED =    .83377E+08
        PRESENT MASS DISSOLVED =    .46575E+05
        CHANGE MASS DISSOLVED   =  -.83330E+08
        CHANGE TOTL.MASS STORED=  -.11250E+09
      COMPARE RESIDUAL WITH NET FLUX AND MASS ACCUMULATION:
        MASS BALANCE RESIDUAL   =    .78585E+07
        ERROR   (AS PERCENT)    =    .00000E+00
      COMPARE INITIAL MASS STORED WITH CHANGE IN MASS STORED:
        ERROR   (AS PERCENT)    =  -.36181E+01
1Emerson Electric--Altamonte Springs, Florida
```

Figure 8. Chemical Mass Balance
After 2.5 Years of Pumping

After system start-up, a rapid decrease was observed in contaminant concentrations which eventually tailed off. This conclusion was somewhat true for the Emerson Electric site, in particular for DCA, DCE, and TCA. The initial reduction was a little more erratic, but the pattern held true for the xylenes, MEK, and MIBK (Figs. 6 and 7). The tailing effects at Emerson were not very pronounced since all the contaminants plotted went to non-detect within 3-1/2 years from the initial sampling. The tailing effect would have been more evident, had each extraction well been monitored individually instead of as a composite.

One possible reason for the tailing effect present at many sites could be the slow release of contaminant by the organic carbon in the soil. Since very little organic carbon was present at the Emerson site, the tailing effect was not very pronounced and the site was shown to be remediated relatively rapidly.

With the high levels of VOCs present, in particular toluene, xylenes, MEK, and MIBK the presence of LNAPLs was a distinct possibility at the Emerson Electric site, especially with the lower solubilities of toluene and the xylenes. An effort should have been made by ESE to determine if there was a layer of contaminant present on the water. This could also have been achieved by more detailed soil investigation as mentioned above.

Since many of the contaminants present at the Emerson Electric site were denser than water (DCA, DCE, tetrachloroethene (PERC), TCE, and TCA), an investigation consisting of discrete sampling to determine the presence of DNAPLs should have been initiated but was not.

There were no steps taken to re-assess the remediation of Emerson Electric other than to monitor the continuing decrease in contaminant levels. Apparently ESE felt that as long as the levels were decreasing, there was no need for adjustment of the system.

SUMMARY

The Emerson Electric site remediation was determined to be a success by taking the contaminants present to below Florida standard by means of composite sampling the five extraction wells. If ESE had been required to take discrete samples, the remediation would probably have continued for several months, perhaps operating only those wells which were not below Florida guidelines.

It is possible that the site took longer than anticipated for remediation due to the presence of NAPLs which were not investigated during the original site assessment.

The conclusion drawn from the modeling of the site is that an additional 0.9 years of pumping would have been needed to take the composite samples to non-detect levels. This is based on a calibration by means of matching levels of contaminant extracted as shown in the model to those analyzed from the field. This does not eliminate the possibility that some of the plume escaped the cone of influence of the extraction wells since there was no downgradient monitoring. This theory is supported by the chemical mass balance generated at the end of Pumping Period

1. The probability is high that there is still contamination present at the Emerson Electric site.

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APPENDIXES

APPENDIX A

INPUT FILE FOR EMERSON ELECTRIC MODEL

```
Emerson Electric--Altamonte Springs, Florida
  30   2  16  205200  30    7    5 150    5  16    1    0    0    0
0    0    1
  2.5.0010   .35   11..0000   .00    0.   25.   25.   .50   .50 1.00
    6.250000E-02          1.960000      0.000000E+00
 512
 516
 517
 417
 414
 512 .13E-01 .00
 516 .13E-01 .00
 517 .13E-01 .00
 417 .13E-01 .00
 414 .13E-01 .00
0  .234E-02
0  50.0
0  .000
1  1.00
0000000000000000
0111111111111110
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0000000000000000
0111111111111110
0000000000000000
 1  1.00        .000        .000       0
1  .100
  0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
  0.793.795.798.800.803.807.810.812.815.817.819.821.824.826.
0.
  0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
  0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
  0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
  0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
```

```
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.768.770.771.773.775.776.778.780.782.783.785.787.788.790.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
1  1.00
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   0.   0.   1.   1.   1.   1.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   1.   1.100.100.100.   1.   0.   0.   0.   0.   0.   0.   0.   0.
0.
   0.   1.100.300.500.100.   1.   0.   0.   0.   0.   0.   0.   0.   0.
0.
```

```
  0.  1.100.500.500.100.  1.  0.  0.  0.  0.  0.  0.  0.  0.
0.
  0.  1.100.500.500.100.  1.  0.  0.  0.  0.  0.  0.  0.  0.
0.
  0.  1.100.500.500.100.  1.  0.  0.  0.  0.  0.  0.  0.  0.
0.
  0.  1.100.500.500.100.  1.  0.  0.  0.  0.  0.  0.  0.  0.
0.
  0.  1.100.500.500.100.  0.  0.  0.  0.  0.  0.  0.  0.  0.
0.
  0.  1.100.100.100.  1.  0.  0.  0.  0.  0.  0.  0.  0.  0.
0.
  0.  0.  1.  1.  1.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
0.
  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.  0.
0.
1
  30  30   7 100   5   0   0   0   0   0  .9 1.00   0.
 512 .13E-01 .00
 516 .13E-01 .00
 517 .13E-01 .00
 417 .13E-01 .00
 414 .13E-01 .00
```

APPENDIX B

OUTPUT FILE FOR EMERSON ELECTRIC MODEL

```
1U.S.G.S. METHOD-OF-CHARACTERISTICS MODEL FOR SOLUTE
TRANSPORT IN GROUND WATER
0Emerson Electric--Altamonte Springs, Florida

0                    I N P U T    D A T A
0                      GRID DESCRIPTORS

             NX     (NUMBER OF COLUMNS)  =    16
             NY     (NUMBER OF ROWS)     =    20
             XDEL   (X-DISTANCE IN FEET) =    25.0
             YDEL   (Y-DISTANCE IN FEET) =    25.0
0                      TIME  PARAMETERS

             NTIM   (MAX. NO. OF TIME STEPS)        =      30
             NPMP   (NO. OF PUMPING PERIODS)        =       2
             PINT   (PUMPING PERIOD IN YEARS)       =
2.500
             TIMX   (TIME INCREMENT MULTIPLIER)     =
.00
             TINIT  (INITIAL TIME STEP IN SEC.)     =      0.
0              HYDROLOGIC AND CHEMICAL PARAMETERS

             S        (STORAGE COEFFICIENT)        =
.000000
             POROS    (EFFECTIVE POROSITY)         =
.350
             BETA     (LONGITUDINAL DISPERSIVITY) =     11.0
             DLTRAT   (RATIO OF TRANSVERSE TO
                       LONGITUDINAL DISPERSIVITY)  =       .50
             ANFCTR   (RATIO OF T-YY TO T-XX)      =
1.000000
0                    EXECUTION PARAMETERS

             NITP    (NO. OF ITERATION PARAMETERS) =    7
             TOL     (CONVERGENCE CRITERIA - ADIP) =   .10E-
02
             ITMAX   (MAX.NO.OF ITERATIONS - ADIP) =  150
             CELDIS  (MAX.CELL DISTANCE PER MOVE
                         OF PARTICLES - M.O.C.)    =      .500
             NPMAX   (MAX. NO. OF PARTICLES)       = 5200
             NPTPND  (NO. PARTICLES PER NODE)      =    16
1
0                      PROGRAM OPTIONS

             NPNT    (TIME STEP INTERVAL FOR
                      COMPLETE PRINTOUT)       =    30
             NPNTMV  (MOVE INTERVAL FOR CHEM.
                      CONCENTRATION PRINTOUT)  =     0
             NPNTVL  (TIME STEP INTERVAL FOR
                      VELOCITY PRINTOUT; 0=NEVER;
                      -1=FIRST TIME STEP;
                      -2=LAST TIME STEP)       =     0
             NPNTD   (PRINT OPTION-DISP.COEF.
                      0=NO; 1=FIRST TIME STEP;
```

```
             2=ALL TIME STEPS)         =      0
NUMOBS (NO. OF OBSERVATION WELLS
             FOR HYDROGRAPH PRINTOUT) =      5
NREC   (NO. OF PUMPING WELLS)         =      5
NCODES (FOR NODE IDENT.)              =      1
NPNCHV (TIME STEP INTERVAL FOR
             VELOCITY PRINTOUT ON
             FILE UNIT 7; 0=NEVER;
             -1=FIRST TIME STEP;
             -2=LAST TIME STEP)        =      0
NPDELC (PRINT OPT.-CONC. CHANGE) =      0
IREACT (REACTION SPECIFIER)           =      1


             REACTION - LINEAR SORPTION

             RHOB     (BULK DENSITY)                    =
1.96000E+00
             DK       (DISTRIBUTION COEFFICIENT)        =
6.25000E-02
             RF       (RETARDATION FACTOR)              =
1.35000E+00
1               STEADY-STATE FLOW

     TIME INTERVALS (IN SEC) FOR SOLUTE-TRANSPORT SIMULATION
     .26298E+07  .26298E+07  .26298E+07  .26298E+07
.26298E+07  .26298E+07  .26298E+07  .26298E+07  .26298E+07
.26298E+07
     .26298E+07  .26298E+07  .26298E+07  .26298E+07
.26298E+07  .26298E+07  .26298E+07  .26298E+07  .26298E+07
.26298E+07
     .26298E+07  .26298E+07  .26298E+07  .26298E+07
.26298E+07  .26298E+07  .26298E+07  .26298E+07  .26298E+07
.26298E+07

0          LOCATION OF OBSERVATION WELLS

                NO.     X     Y

                 1      5    12
                 2      5    16
                 3      5    17
                 4      4    17
                 5      4    14

0          LOCATION  OF  PUMPING  WELLS

           X   Y   RATE(IN CFS)   CONC.

           5  12       .0130        .00
           5  16       .0130        .00
           5  17       .0130        .00
           4  17       .0130        .00
           4  14       .0130        .00
```

```
0          AREA OF ONE CELL =    625.0
0          X-Y SPACING:
              25.000
              25.000
1TRANSMISSIVITY MAP (FT*FT/SEC)

   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
   2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
0.00E+00
   0.00E+00  2.34E-03  2.34E-03  2.34E-03  2.34E-03  2.34E-
03  2.34E-03  2.34E-03  2.34E-03  2.34E-03
```

2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-
03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-
03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-
03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-
03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-
03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-
03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-
03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
2.34E-03 2.34E-03 2.34E-03 2.34E-03 2.34E-03
0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00
1AQUIFER THICKNESS (FT)

.0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0
.0 .0 .0 .0 .0
.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0 .0
.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0 .0
.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0 .0
.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0 .0
.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0 .0
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50.0 50.0 50.0 50.0 .0

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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
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      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0   .0
      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0   .0
      .0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0 50.0
50.0 50.0 50.0 50.0   .0
      .0   .0   .0   .0   .0   .0   .0   .0   .0   .0   .0
 .0   .0   .0   .0   .0
1DIFFUSE RECHARGE AND DISCHARGE (FT/SEC)

   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
```

```
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
1PERMEABILTY MAP (FT/SEC)

   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
```

```
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
   0.00E+00  4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-
05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
   4.68E-05  4.68E-05  4.68E-05  4.68E-05  4.68E-05
0.00E+00
```

0.00E+00 4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-
05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
0.00E+00
0.00E+00 4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-
05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
0.00E+00
0.00E+00 4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-
05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
0.00E+00
0.00E+00 4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-
05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
0.00E+00
0.00E+00 4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-
05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
4.68E-05 4.68E-05 4.68E-05 4.68E-05 4.68E-05
0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00
0 NO. OF FINITE-DIFFERENCE CELLS IN AQUIFER = 252

AREA OF AQUIFER IN MODEL = .15750E+06 SQ. FT.

NZCRIT (MAX. NO. OF CELLS THAT CAN BE VOID OF PARTICLES; IF EXCEEDED, PARTICLES ARE REGENERATED) = 5

1NODE IDENTIFICATION MAP

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

```
    0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
    0   1   1   1   1   1   1   1   1   1   1   1   1   1   1   0
    0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
0      NO. OF NODE IDENT. CODES SPECIFIED =  1
0           THE FOLLOWING ASSIGNMENTS HAVE BEEN MADE:
     CODE NO.      LEAKANCE      SOURCE CONC.     RECHARGE
0        1          .100E+01            .00
1VERTICAL PERMEABILITY/THICKNESS (FT/(FT*SEC))

   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  1.00E+00  1.00E+00  1.00E+00  1.00E+00
1.00E+00  1.00E+00  1.00E+00  1.00E+00  1.00E+00
   1.00E+00  1.00E+00  1.00E+00  1.00E+00  1.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
```

```
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
   0.00E+00  1.00E+00  1.00E+00  1.00E+00  1.00E+00
1.00E+00  1.00E+00  1.00E+00  1.00E+00  1.00E+00
   1.00E+00  1.00E+00  1.00E+00  1.00E+00  1.00E+00
0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00
1WATER TABLE

    0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.   0.   0.   0.   0.
    0.  79.  80.  80.  80.  80.  81.  81.  81.  82.  82.
82.  82.  82.  83.   0.
    0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.   0.   0.   0.   0.
    0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.   0.   0.   0.   0.
    0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.   0.   0.   0.   0.
    0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.   0.   0.   0.   0.
    0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.   0.   0.   0.   0.
    0.   0.   0.   0.   0.   0.   0.   0.   0.   0.   0.
0.   0.   0.   0.   0.
```

```
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
    0.   77.   77.   77.   77.   78.   78.   78.   78.   78.   78.
79.   79.   79.   79.    0.
    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.
1HEAD DISTRIBUTION - ROW
 NUMBER OF TIME STEPS =      0
       TIME(SECONDS) =    .00000
       TIME(DAYS)    =    .00000E+00
       TIME(YEARS)   =    .00000E+00

0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000  79.3000000  79.5000000  79.8000000
80.0000000  80.3000000  80.7000000  81.0000000  81.2000000
81.5000000
0  81.7000000  81.9000000  82.1000000  82.4000000
82.6000000    .0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
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0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000    .0000000    .0000000    .0000000
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0    .0000000    .0000000    .0000000    .0000000
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0    .0000000    .0000000    .0000000    .0000000
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0    .0000000    .0000000    .0000000    .0000000
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0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
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0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
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0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
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0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000     .0000000     .0000000     .0000000
.0000000
0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000
0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000     .0000000     .0000000     .0000000
.0000000
0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000
0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000     .0000000     .0000000     .0000000
.0000000
0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000
0     .0000000   76.8000000   77.0000000   77.1000000
77.3000000   77.5000000   77.6000000   77.8000000   78.0000000
78.2000000
0   78.3000000   78.5000000   78.7000000   78.8000000
79.0000000     .0000000
0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000     .0000000     .0000000     .0000000
.0000000
0     .0000000     .0000000     .0000000     .0000000
.0000000     .0000000
1ITERATION PARAMETERS
            .616850E-02
            .144040E-01
            .336346E-01
            .785398E-01
            .183397
            .428249
            1.00000
1CONCENTRATION

 NUMBER OF TIME STEPS =      0
        TIME(SECONDS) =    .00000
   CHEM.TIME(SECONDS) =    .00000E+00
   CHEM.TIME(DAYS)    =    .00000E+00
        TIME(YEARS)   =    .00000E+00
   CHEM.TIME(YEARS)   =    .00000E+00
  NO. MOVES COMPLETED =      0

0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
```

```
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    1    1    1    1    0    0    0    0
0    0    0    0    0
0    0    1    1  100  100  100    1    0    0    0    0
0    0    0    0    0
0    0    1  100  300  500  100    1    0    0    0    0
0    0    0    0    0
0    0    1  100  500  500  100    1    0    0    0    0
0    0    0    0    0
0    0    1  100  500  500  100    1    0    0    0    0
0    0    0    0    0
0    0    1  100  500  500  100    1    0    0    0    0
0    0    0    0    0
0    0    1  100  500  500  100    1    0    0    0    0
0    0    0    0    0
0    0    1  100  500  500  100    0    0    0    0    0
0    0    0    0    0
0    0    1  100  100  100    1    0    0    0    0    0
0    0    0    0    0
0    0    0    1    1    1    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0

   N =    1
   NUMBER OF ITERATIONS =   20
1           STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21002E+07
  TIMV (CELDIS)   =   .83258E+06
0 TIMV =  8.33E+05     NTIMV =     3     NMOV =     4

   TIM (N)   =   .26298E+07
   TIMEVELO =   .65745E+06
   TIMEDISP =   .10999E+07
0 TIMV =  6.57E+05     NTIMD =     2     NMOV =     4
0           THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4
```

```
0  NP          =          4032          IMOV      =           1
   TIM(N)      =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .65745E+06
0  NP          =          4036          IMOV      =           2
   TIM(N)      =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .13149E+07
0  NP          =          4077          IMOV      =           3
   TIM(N)      =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .19724E+07
0  NP          =          4137          IMOV      =           4
   TIM(N)      =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .26298E+07
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.     X    Y
N      HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                            1           5   12


0          .0          500.0            .000

1        70.7          210.9            .021

2        70.7          196.3            .042

3        70.7          151.2            .063

4        70.7          148.0            .083
0                      OBS.WELL NO.     X    Y
N      HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                            2           5   16


0          .0          500.0            .000
```

1	69.6	349.6		.021
2	69.6	265.9		.042
3	69.6	218.5		.063
4	69.6	172.6		.083
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		3	5	17
0	.0	500.0		.000
1	70.5	179.8		.021
2	70.5	119.8		.042
3	70.5	92.4		.063
4	70.5	58.0		.083
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		4	4	17
0	.0	500.0		.000
1	70.5	217.9		.021
2	70.5	145.1		.042
3	70.5	118.4		.063
4	70.5	84.5		.083
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		5	4	14
0	.0	500.0		.000
1	69.3	471.6		.021
2	69.3	349.3		.042
3	69.3	361.6		.063

```
4          69.3          298.9          .083
0

   N =     2
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =     4


0  NP       =          4137          IMOV     =            1
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .32873E+07
0  NP       =          4248          IMOV     =            2
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .39447E+07
0  NP       =          4248          IMOV     =            3
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .46022E+07
0  NP       =          4312          IMOV     =            4
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .52596E+07
1Emerson Electric--Altamonte Springs, Florida


0    TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                     OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                          1          5   12



0          .0          500.0          .000

1        70.7          136.6          .104

2        70.7          124.0          .125

3        70.7           97.8          .146

4        70.7           74.3          .167
```

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		2	5	16
0	.0	500.0		.000
1	69.6	158.3		.104
2	69.6	144.9		.125
3	69.6	115.3		.146
4	69.6	90.7		.167

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		3	5	17
0	.0	500.0		.000
1	70.5	47.0		.104
2	70.5	37.2		.125
3	70.5	30.1		.146
4	70.5	23.9		.167

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		4	4	17
0	.0	500.0		.000
1	70.5	57.0		.104
2	70.5	51.3		.125
3	70.5	33.4		.146
4	70.5	30.0		.167

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		5	4	14

```
0            .0            500.0           .000

1          69.3            318.2           .104

2          69.3            296.1           .125

3          69.3            271.6           .146

4          69.3            222.0           .167
0

   N =     3
   NUMBER OF ITERATIONS = 0   (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =     4


0  NP        =          4370          IMOV     =            1
   TIM(N)    =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .59171E+07
0  NP        =          4410          IMOV     =            2
   TIM(N)    =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .65745E+07
0  NP        =          4410          IMOV     =            3
   TIM(N)    =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .72320E+07
0  NP        =          4553          IMOV     =            4
   TIM(N)    =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .78894E+07
1Emerson Electric--Altamonte Springs, Florida


0    TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0               STEADY-STATE SOLUTION



0                     OBS.WELL NO.     X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           1          5   12



0            .0            500.0           .000
```

```
1           70.7          63.6              .188

2           70.7          43.4              .208

3           70.7          40.9              .229

4           70.7          43.3              .250
0                      OBS.WELL NO.     X     Y
N         HEAD (FT)   CONC.(MG/L)    TIME  (YEARS)

                           2             5    16


0             .0         500.0              .000

1           69.6          91.9              .188

2           69.6          53.3              .208

3           69.6          81.7              .229

4           69.6          34.1              .250
0                      OBS.WELL NO.     X     Y
N         HEAD (FT)   CONC.(MG/L)    TIME  (YEARS)

                           3             5    17


0             .0         500.0              .000

1           70.5          17.8              .188

2           70.5          16.3              .208

3           70.5          13.1              .229

4           70.5          11.5              .250
0                      OBS.WELL NO.     X     Y
N         HEAD (FT)   CONC.(MG/L)    TIME  (YEARS)

                           4             4    17


0             .0         500.0              .000

1           70.5          21.8              .188

2           70.5          19.4              .208

3           70.5          14.5              .229
```

```
4         70.5            13.4            .250
0                     OBS.WELL NO.     X    Y
N      HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                           5           4   14



0           .0            500.0           .000

1         69.3            202.8           .188

2         69.3            207.7           .208

3         69.3            177.7           .229

4         69.3            161.9           .250
0

   N =     4
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =     4


0  NP       =          4553          IMOV     =            1
   TIM(N)   =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .85469E+07
0  NP       =          4563          IMOV     =            2
   TIM(N)   =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .92043E+07
0  NP       =          4621          IMOV     =            3
   TIM(N)   =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .98618E+07
0  NP       =          4692          IMOV     =            4
   TIM(N)   =   .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .10519E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION
```

```
0                   OBS.WELL NO.     X    Y
N     HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         1           5   12


0          .0          500.0            .000

1        70.7           46.9            .271

2        70.7           32.4            .292

3        70.7           31.7            .313

4        70.7           26.7            .333
0                   OBS.WELL NO.     X    Y
N     HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         2           5   16


0          .0          500.0            .000

1        69.6           54.7            .271

2        69.6           37.0            .292

3        69.6           20.1            .313

4        69.6           33.2            .333
0                   OBS.WELL NO.     X    Y
N     HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         3           5   17


0          .0          500.0            .000

1        70.5            9.3            .271

2        70.5            8.9            .292

3        70.5            6.4            .313

4        70.5            6.4            .333
0                   OBS.WELL NO.     X    Y
N     HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         4           4   17
```

```
0              .0          500.0            .000

1            70.5           11.6            .271

2            70.5           11.3            .292

3            70.5            8.7            .313

4            70.5            8.0            .333
0                       OBS.WELL NO.     X    Y
N       HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                               5          4   14


0              .0          500.0            .000

1            69.3          146.1            .271

2            69.3          152.2            .292

3            69.3          123.1            .313

4            69.3          100.2            .333
0

   N =     5
   NUMBER OF ITERATIONS = 0   (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =           4692          IMOV      =          1
   TIM(N)    =    .26298E+07           TIMV      =  .65745E+06
SUMTCH =   .11177E+08
0  NP        =           4803          IMOV      =          2
   TIM(N)    =    .26298E+07           TIMV      =  .65745E+06
SUMTCH =   .11834E+08
0  NP        =           4803          IMOV      =          3
   TIM(N)    =    .26298E+07           TIMV      =  .65745E+06
SUMTCH =   .12492E+08
0  NP        =           4843          IMOV      =          4
   TIM(N)    =    .26298E+07           TIMV      =  .65745E+06
SUMTCH =   .13149E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.     1
```

0 STEADY-STATE SOLUTION

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X TIME	Y (YEARS)
		1	5	12
0	.0	500.0		.000
1	70.7	31.3		.354
2	70.7	22.2		.375
3	70.7	20.3		.396
4	70.7	17.7		.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X TIME	Y (YEARS)
		2	5	16
0	.0	500.0		.000
1	69.6	20.8		.354
2	69.6	19.6		.375
3	69.6	20.0		.396
4	69.6	15.8		.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X TIME	Y (YEARS)
		3	5	17
0	.0	500.0		.000
1	70.5	5.4		.354
2	70.5	4.5		.375
3	70.5	3.7		.396

```
4         70.5           3.6           .417
0                     OBS.WELL NO.    X    Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         4             4   17



0           .0         500.0           .000

1         70.5           6.8           .354

2         70.5           6.1           .375

3         70.5           4.8           .396

4         70.5           4.8           .417
0                     OBS.WELL NO.    X    Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         5             4   14



0           .0         500.0           .000

1         69.3         103.3           .354

2         69.3          82.7           .375

3         69.3          78.3           .396

4         69.3          83.4           .417
0

   N =    6
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          4893         IMOV      =          1
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .13806E+08
0  NP        =          4921         IMOV      =          2
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .14464E+08
0  NP        =          4921         IMOV      =          3
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .15121E+08
0  NP        =          5071         IMOV      =          4
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .15779E+08
```

1Emerson Electric--Altamonte Springs, Florida

0 TIME VERSUS HEAD AND CONCENTRATION AT SELECTED OBSERVATION POINTS

PUMPING PERIOD NO. 1

0 STEADY-STATE SOLUTION

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X TIME	Y (YEARS)
		1	5	12
0	.0	500.0		.000
1	70.7	16.0		.438
2	70.7	13.5		.458
3	70.7	13.5		.479
4	70.7	11.4		.500

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X TIME	Y (YEARS)
		2	5	16
0	.0	500.0		.000
1	69.6	14.4		.438
2	69.6	12.5		.458
3	69.6	9.4		.479
4	69.6	12.6		.500

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X TIME	Y (YEARS)
		3	5	17

```
0          .0         500.0          .000

1        70.5           3.0          .438

2        70.5           2.8          .458

3        70.5           2.3          .479

4        70.5           2.1          .500
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        4          4   17


0          .0         500.0          .000

1        70.5           3.8          .438

2        70.5           3.5          .458

3        70.5           2.7          .479

4        70.5           2.8          .500
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        5          4   14


0          .0         500.0          .000

1        69.3          76.6          .438

2        69.3          77.0          .458

3        69.3          52.0          .479

4        69.3          60.7          .500
0

   N =    7
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP       =         5071         IMOV      =          1
   TIM(N)   =   .26298E+07         TIMV      =   .65745E+06
SUMTCH =   .16436E+08
0  NP       =         5079         IMOV      =          2
```

```
   TIM(N)    =    .26298E+07              TIMV       =     .65745E+06
SUMTCH =    .17094E+08
0  NP        =           5110              IMOV       =               3
   TIM(N)    =    .26298E+07              TIMV       =     .65745E+06
SUMTCH =    .17751E+08
0       ***    NOTE    ***          NPTM.EQ.NPMAX --- IMOV=    4
PT. NO.=4880      CALL GENPT

0  NP        =           4032              IMOV       =               4
   TIM(N)    =    .26298E+07              TIMV       =     .65745E+06
SUMTCH =    .18409E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

                    PUMPING PERIOD NO.    1



0                   STEADY-STATE SOLUTION



0                          OBS.WELL NO.     X     Y
N       HEAD (FT)        CONC.(MG/L)     TIME  (YEARS)

                                 1          5    12


0             .0             500.0              .000

1           70.7              12.5              .521

2           70.7              10.5              .542

3           70.7               8.4              .563

4           70.7               6.5              .583
0                          OBS.WELL NO.     X     Y
N       HEAD (FT)        CONC.(MG/L)     TIME  (YEARS)

                                 2          5    16


0             .0             500.0              .000

1           69.6               7.5              .521
```

2	69.6	8.2	.542
3	69.6	7.6	.563
4	69.6	6.5	.583

0		OBS.WELL NO.	X	Y
		3	5	17

N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
0	.0	500.0	.000
1	70.5	1.9	.521
2	70.5	1.7	.542
3	70.5	1.4	.563
4	70.5	1.3	.583

0		OBS.WELL NO.	X	Y
		4	4	17

N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
0	.0	500.0	.000
1	70.5	2.4	.521
2	70.5	2.3	.542
3	70.5	1.7	.563
4	70.5	1.8	.583

0		OBS.WELL NO.	X	Y
		5	4	14

N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
0	.0	500.0	.000
1	69.3	49.6	.521
2	69.3	46.0	.542
3	69.3	38.1	.563
4	69.3	34.1	.583

```
0

   N =     8
   NUMBER OF ITERATIONS = 0   (HEADS UNCHANGED)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =     4


0  NP         =          4036          IMOV      =           1
   TIM(N)     =    .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .19066E+08
0  NP         =          4077          IMOV      =           2
   TIM(N)     =    .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .19724E+08
0  NP         =          4137          IMOV      =           3
   TIM(N)     =    .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .20381E+08
0  NP         =          4137          IMOV      =           4
   TIM(N)     =    .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .21038E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.     X     Y
N      HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)

                            1           5    12



0          .0          500.0              .000

1        70.7            7.5              .604

2        70.7            6.4              .625

3        70.7            6.8              .646

4        70.7            6.3              .667
0                      OBS.WELL NO.     X     Y
N      HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)
```

2 5 16

0	.0	500.0	.000
1	69.6	7.6	.604
2	69.6	6.5	.625
3	69.6	5.2	.646
4	69.6	5.0	.667

0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

3 5 17

0	.0	500.0	.000
1	70.5	1.1	.604
2	70.5	1.1	.625
3	70.5	1.0	.646
4	70.5	.9	.667

0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

4 4 17

0	.0	500.0	.000
1	70.5	1.3	.604
2	70.5	1.4	.625
3	70.5	1.2	.646
4	70.5	1.1	.667

0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

5 4 14

0	.0	500.0	.000

```
1          69.3          32.5          .604

2          69.3          29.3          .625

3          69.3          28.1          .646

4          69.3          26.4          .667
0

   N =     9
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =     4


0  NP        =          4248          IMOV     =            1
   TIM(N)    =    .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .21696E+08
0  NP        =          4248          IMOV     =            2
   TIM(N)    =    .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .22353E+08
0  NP        =          4312          IMOV     =            3
   TIM(N)    =    .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .23011E+08
0  NP        =          4370          IMOV     =            4
   TIM(N)    =    .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .23668E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                           1          5   12



0          .0          500.0          .000

1         70.7           6.1          .688
```

2	70.7	5.0		.708
3	70.7	4.8		.729
4	70.7	4.2		.750
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		2	5	16
0	.0	500.0		.000
1	69.6	6.4		.688
2	69.6	4.7		.708
3	69.6	3.9		.729
4	69.6	4.0		.750
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		3	5	17
0	.0	500.0		.000
1	70.5	.8		.688
2	70.5	.7		.708
3	70.5	.6		.729
4	70.5	.5		.750
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		4	4	17
0	.0	500.0		.000
1	70.5	1.0		.688
2	70.5	.7		.708
3	70.5	.7		.729
4	70.5	.6		.750

```
0                      OBS.WELL NO.     X    Y
N       HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)

                            5           4    14



0          .0            500.0            .000

1        69.3             24.6            .688

2        69.3             23.6            .708

3        69.3             21.0            .729

4        69.3             20.3            .750
0

   N =    10
   NUMBER OF ITERATIONS = 0   (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          4410           IMOV     =          1
   TIM(N)    =    .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .24326E+08
0  NP        =          4410           IMOV     =          2
   TIM(N)    =    .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .24983E+08
0  NP        =          4553           IMOV     =          3
   TIM(N)    =    .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .25641E+08
0  NP        =          4553           IMOV     =          4
   TIM(N)    =    .26298E+07           TIMV     =   .65745E+06
SUMTCH =   .26298E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.     X    Y
N       HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)
```

		1	5	12
0	.0	500.0		.000
1	70.7	3.4		.771
2	70.7	3.4		.792
3	70.7	3.4		.813
4	70.7	3.6		.833
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		2	5	16
0	.0	500.0		.000
1	69.6	2.3		.771
2	69.6	3.9		.792
3	69.6	1.9		.813
4	69.6	3.5		.833
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		3	5	17
0	.0	500.0		.000
1	70.5	.5		.771
2	70.5	.4		.792
3	70.5	.4		.813
4	70.5	.4		.833
0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		4	4	17
0	.0	500.0		.000

```
1         70.5              .6           .771

2         70.5              .5           .792

3         70.5              .5           .813

4         70.5              .5           .833
0                     OBS.WELL NO.    X     Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         5          4   14



0           .0           500.0         .000

1         69.3            18.6         .771

2         69.3            17.2         .792

3         69.3            16.1         .813

4         69.3            15.5         .833
0

   N =    11
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          4563         IMOV      =          1
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .26955E+08
0  NP        =          4621         IMOV      =          2
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .27613E+08
0  NP        =          4692         IMOV      =          3
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .28270E+08
0  NP        =          4692         IMOV      =          4
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .28928E+08
1Emerson Electric--Altamonte Springs, Florida


0    TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1
```

0 STEADY-STATE SOLUTION

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		1	5	12
0	.0	500.0		.000
1	70.7	2.7		.854
2	70.7	2.7		.875
3	70.7	2.3		.896
4	70.7	2.5		.917

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		2	5	16
0	.0	500.0		.000
1	69.6	2.2		.854
2	69.6	1.2		.875
3	69.6	2.1		.896
4	69.6	1.4		.917

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		3	5	17
0	.0	500.0		.000
1	70.5	.4		.854
2	70.5	.3		.875
3	70.5	.3		.896
4	70.5	.3		.917

```
0                   OBS.WELL NO.      X    Y
N       HEAD (FT)   CONC.(MG/L)     TIME  (YEARS)

                          4            4   17



0            .0         500.0              .000

1          70.5            .5              .854

2          70.5            .4              .875

3          70.5            .4              .896

4          70.5            .4              .917
0                   OBS.WELL NO.      X    Y
N       HEAD (FT)   CONC.(MG/L)     TIME  (YEARS)

                          5            4   14



0            .0         500.0              .000

1          69.3          13.5              .854

2          69.3          13.9              .875

3          69.3          13.2              .896

4          69.3          12.7              .917
0

   N =    12
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          4803          IMOV     =          1
   TIM(N)    =   .26298E+07           TIMV     =  .65745E+06
SUMTCH =   .29585E+08
0  NP        =          4803          IMOV     =          2
   TIM(N)    =   .26298E+07           TIMV     =  .65745E+06
SUMTCH =   .30243E+08
0  NP        =          4843          IMOV     =          3
   TIM(N)    =   .26298E+07           TIMV     =  .65745E+06
SUMTCH =   .30900E+08
0  NP        =          4893          IMOV     =          4
   TIM(N)    =   .26298E+07           TIMV     =  .65745E+06
SUMTCH =   .31558E+08
1Emerson Electric--Altamonte Springs, Florida
```

```
0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                   OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         1          5   12



0        .0         500.0          .000

1      70.7           2.0          .938

2      70.7           2.0          .958

3      70.7           1.8          .979

4      70.7           1.6         1.000
0                   OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         2          5   16



0        .0         500.0          .000

1      69.6           1.4          .938

2      69.6           1.2          .958

3      69.6           1.1          .979

4      69.6           1.0         1.000
0                   OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         3          5   17



0        .0         500.0          .000
```

```
 1          70.5               .2           .938

 2          70.5               .2           .958

 3          70.5               .2           .979

 4          70.5               .2          1.000
 0                       OBS.WELL NO.     X     Y
 N       HEAD (FT)     CONC.(MG/L)      TIME  (YEARS)

                            4             4    17


 0            .0          500.0            .000

 1          70.5             .3            .938

 2          70.5             .3            .958

 3          70.5             .3            .979

 4          70.5             .3           1.000
 0                       OBS.WELL NO.     X     Y
 N       HEAD (FT)     CONC.(MG/L)      TIME  (YEARS)

                            5             4    14


 0            .0          500.0            .000

 1          69.3           11.7            .938

 2          69.3           11.1            .958

 3          69.3            9.7            .979

 4          69.3            9.7           1.000
 0

   N =   13
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
 0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
 TIME STEP  =    4

 0  NP       =          4921         IMOV      =            1
    TIM(N)   =    .26298E+07         TIMV      =   .65745E+06
 SUMTCH =    .32215E+08
 0  NP       =          4921         IMOV      =            2
    TIM(N)   =    .26298E+07         TIMV      =   .65745E+06
 SUMTCH =    .32873E+08
```

```
0   NP          =           5071            IMOV     =            3
    TIM(N)      =    .26298E+07            TIMV     =    .65745E+06
SUMTCH =    .33530E+08
0   NP          =           5071            IMOV     =            4
    TIM(N)      =    .26298E+07            TIMV     =    .65745E+06
SUMTCH =    .34187E+08
1Emerson Electric--Altamonte Springs, Florida

0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                        OBS.WELL NO.    X    Y
N      HEAD (FT)      CONC.(MG/L)    TIME  (YEARS)

                             1           5   12


0          .0           500.0           .000

1        70.7             1.5          1.021

2        70.7             1.5          1.042

3        70.7             1.3          1.063

4        70.7             1.4          1.083
0                        OBS.WELL NO.    X    Y
N      HEAD (FT)      CONC.(MG/L)    TIME  (YEARS)

                             2           5   16


0          .0           500.0           .000

1        69.6             1.1          1.021

2        69.6              .8          1.042

3        69.6             1.0          1.063

4        69.6              .6          1.083
```

```
0
N        HEAD (FT)     OBS.WELL NO.      X     Y
                       CONC.(MG/L)     TIME (YEARS)

                           3             5    17


0           .0           500.0             .000

1         70.5              .2            1.021

2         70.5              .2            1.042

3         70.5              .2            1.063

4         70.5              .1            1.083
0                      OBS.WELL NO.      X     Y
N        HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                           4             4    17


0           .0           500.0             .000

1         70.5              .2            1.021

2         70.5              .2            1.042

3         70.5              .2            1.063

4         70.5              .2            1.083
0                      OBS.WELL NO.      X     Y
N        HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                           5             4    14


0           .0           500.0             .000

1         69.3            10.8            1.021

2         69.3             7.5            1.042

3         69.3             7.8            1.063

4         69.3             7.4            1.083
0

   N =    14
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4
```

```
0  NP         =          5079          IMOV      =           1
   TIM(N)     =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .34845E+08
0  NP         =          5110          IMOV      =           2
   TIM(N)     =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .35502E+08
0      ***   NOTE   ***             NPTM.EQ.NPMAX --- IMOV=    3
PT. NO.=4880     CALL GENPT

0  NP         =          4032          IMOV      =           3
   TIM(N)     =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .36160E+08
0  NP         =          4036          IMOV      =           4
   TIM(N)     =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .36817E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                          1          5   12


0          .0         500.0           .000

1        70.7           1.2          1.104

2        70.7           1.0          1.125

3        70.7            .8          1.146

4        70.7           1.0          1.167
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                          2          5   16
```

```
0           .0          500.0           .000

1         69.6             .9          1.104

2         69.6             .8          1.125

3         69.6             .7          1.146

4         69.6             .8          1.167
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          3          5   17


0           .0          500.0           .000

1         70.5             .1          1.104

2         70.5             .1          1.125

3         70.5             .1          1.146

4         70.5             .1          1.167
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          4          4   17


0           .0          500.0           .000

1         70.5             .2          1.104

2         70.5             .1          1.125

3         70.5             .2          1.146

4         70.5             .1          1.167
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          5          4   14


0           .0          500.0           .000

1         69.3            6.9          1.104
```

```
2          69.3             6.7          1.125

3          69.3             6.1          1.146

4          69.3             6.8          1.167
0

   N =   15
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP       =          4077          IMOV      =          1
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .37475E+08
0  NP       =          4137          IMOV      =          2
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .38132E+08
0  NP       =          4137          IMOV      =          3
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .38790E+08
0  NP       =          4248          IMOV      =          4
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .39447E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                            1           5   12



0          .0         500.0           .000

1        70.7            .8          1.187

2        70.7            .8          1.208
```

3	70.7	.8	1.229
4	70.7	.8	1.250
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.7	1.187
2	69.6	.6	1.208
3	69.6	.6	1.229
4	69.6	.7	1.250
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.1	1.187
2	70.5	.1	1.208
3	70.5	.1	1.229
4	70.5	.1	1.250
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		4	4 17
0	.0	500.0	.000
1	70.5	.1	1.187
2	70.5	.1	1.208
3	70.5	.1	1.229
4	70.5	.1	1.250
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)

```
                              5          4   14


0          .0            500.0           .000

1        69.3              5.7          1.187

2        69.3              6.1          1.208

3        69.3              4.6          1.229

4        69.3              4.5          1.250
0

   N =   16
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP       =          4248         IMOV     =           1
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .40104E+08
0  NP       =          4312         IMOV     =           2
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .40762E+08
0  NP       =          4370         IMOV     =           3
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .41419E+08
0  NP       =          4410         IMOV     =           4
   TIM(N)   =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .42077E+08
1Emerson Electric--Altamonte Springs, Florida


0    TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0              STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         1           5   12
```

0	.0	500.0	.000
1	70.7	.7	1.271
2	70.7	.7	1.292
3	70.7	.6	1.312
4	70.7	.5	1.333
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.5	1.271
2	69.6	.5	1.292
3	69.6	.5	1.312
4	69.6	.3	1.333
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.1	1.271
2	70.5	.1	1.292
3	70.5	.1	1.312
4	70.5	.1	1.333
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		4	4 17
0	.0	500.0	.000
1	70.5	.1	1.271

```
2          70.5              .1          1.292

3          70.5              .1          1.312

4          70.5              .1          1.333
0                      OBS.WELL NO.    X     Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                             5           4    14



0           .0           500.0            .000

1          69.3            4.7           1.271

2          69.3            4.0           1.292

3          69.3            4.0           1.312

4          69.3            3.6           1.333
0

   N =   17
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          4410         IMOV      =          1
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .42734E+08
0  NP        =          4553         IMOV      =          2
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .43392E+08
0  NP        =          4553         IMOV      =          3
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .44049E+08
0  NP        =          4563         IMOV      =          4
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .44707E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0               STEADY-STATE SOLUTION
```

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)
		1	5 12
0	.0	500.0	.000
1	70.7	.5	1.354
2	70.7	.5	1.375
3	70.7	.5	1.396
4	70.7	.4	1.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.5	1.354
2	69.6	.2	1.375
3	69.6	.5	1.396
4	69.6	.3	1.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.0	1.354
2	70.5	.0	1.375
3	70.5	.0	1.396
4	70.5	.0	1.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)

```
                        4           4   17


0          .0          500.0         .000

1        70.5             .1        1.354

2        70.5             .1        1.375

3        70.5             .1        1.396

4        70.5             .1        1.417
0                   OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        5           4   14


0          .0          500.0         .000

1        69.3            3.8        1.354

2        69.3            3.4        1.375

3        69.3            3.2        1.396

4        69.3            2.7        1.417
0

   N =   18
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP       =          4621         IMOV     =           1
   TIM(N)   =   .26298E+07          TIMV     =  .65745E+06
SUMTCH =   .45364E+08
0  NP       =          4692         IMOV     =           2
   TIM(N)   =   .26298E+07          TIMV     =  .65745E+06
SUMTCH =   .46021E+08
0  NP       =          4692         IMOV     =           3
   TIM(N)   =   .26298E+07          TIMV     =  .65745E+06
SUMTCH =   .46679E+08
0  NP       =          4803         IMOV     =           4
   TIM(N)   =   .26298E+07          TIMV     =  .65745E+06
SUMTCH =   .47336E+08
1Emerson Electric--Altamonte Springs, Florida
```

```
0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

              PUMPING PERIOD NO.    1



0               STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           1           5   12



0          .0          500.0           .000

1        70.7             .4          1.437

2        70.7             .4          1.458

3        70.7             .4          1.479

4        70.7             .3          1.500
0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           2           5   16



0          .0          500.0           .000

1        69.6             .2          1.437

2        69.6             .3          1.458

3        69.6             .2          1.479

4        69.6             .2          1.500
0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           3           5   17



0          .0          500.0           .000
```

```
1           70.5             .0         1.437

2           70.5             .0         1.458

3           70.5             .0         1.479

4           70.5             .0         1.500
0                      OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                             4          4    17


0             .0          500.0          .000

1           70.5             .1         1.437

2           70.5             .1         1.458

3           70.5             .1         1.479

4           70.5             .1         1.500
0                      OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                             5          4    14


0             .0          500.0          .000

1           69.3            3.4         1.437

2           69.3            3.2         1.458

3           69.3            2.8         1.479

4           69.3            2.5         1.500
0

   N =   19
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          4803          IMOV      =            1
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =    .47994E+08
0  NP        =          4843          IMOV      =            2
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =    .48651E+08
```

```
0  NP        =          4893          IMOV     =           3
   TIM(N)    =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .49309E+08
0  NP        =          4921          IMOV     =           4
   TIM(N)    =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .49966E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            1          5   12


0          .0          500.0          .000

1        70.7             .3         1.521

2        70.7             .3         1.542

3        70.7             .3         1.562

4        70.7             .3         1.583
0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            2          5   16


0          .0          500.0          .000

1        69.6             .2         1.521

2        69.6             .2         1.542

3        69.6             .2         1.562

4        69.6             .2         1.583
```

```
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         3           5   17



0          .0         500.0          .000

1        70.5            .0         1.521

2        70.5            .0         1.542

3        70.5            .0         1.562

4        70.5            .0         1.583
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         4           4   17



0          .0         500.0          .000

1        70.5            .0         1.521

2        70.5            .0         1.542

3        70.5            .0         1.562

4        70.5            .0         1.583
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         5           4   14



0          .0         500.0          .000

1        69.3           2.5         1.521

2        69.3           2.1         1.542

3        69.3           2.4         1.562

4        69.3           2.7         1.583
0

   N =   20
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4
```

```
0  NP         =          4921            IMOV      =              1
   TIM(N)     =   .26298E+07             TIMV      =     .65745E+06
SUMTCH =    .50624E+08
0  NP         =          5071            IMOV      =              2
   TIM(N)     =   .26298E+07             TIMV      =     .65745E+06
SUMTCH =    .51281E+08
0  NP         =          5071            IMOV      =              3
   TIM(N)     =   .26298E+07             TIMV      =     .65745E+06
SUMTCH =    .51939E+08
0  NP         =          5079            IMOV      =              4
   TIM(N)     =   .26298E+07             TIMV      =     .65745E+06
SUMTCH =    .52596E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.     X    Y
N      HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                             1          5   12



0          .0          500.0            .000

1        70.7             .2           1.604

2        70.7             .2           1.625

3        70.7             .2           1.646

4        70.7             .2           1.667
0                      OBS.WELL NO.     X    Y
N      HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                             2          5   16



0          .0          500.0            .000
```

```
1        69.6          .1          1.604

2        69.6          .2          1.625

3        69.6          .1          1.646

4        69.6          .2          1.667
0                 OBS.WELL NO.     X     Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                       3           5    17


0          .0       500.0           .000

1        70.5          .0          1.604

2        70.5          .0          1.625

3        70.5          .0          1.646

4        70.5          .0          1.667
0                 OBS.WELL NO.     X     Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                       4           4    17


0          .0       500.0           .000

1        70.5          .0          1.604

2        70.5          .0          1.625

3        70.5          .0          1.646

4        70.5          .0          1.667
0                 OBS.WELL NO.     X     Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                       5           4    14


0          .0       500.0           .000

1        69.3         1.8          1.604

2        69.3         1.7          1.625

3        69.3         1.7          1.646
```

```
4          69.3               1.7            1.667
0

   N =   21
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          5110          IMOV      =            1
   TIM(N)    =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .53253E+08
0      ***   NOTE   ***            NPTM.EQ.NPMAX --- IMOV=   2
PT. NO.=4880      CALL GENPT

0  NP        =          4032          IMOV      =            2
   TIM(N)    =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .53911E+08
0  NP        =          4036          IMOV      =            3
   TIM(N)    =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .54568E+08
0  NP        =          4077          IMOV      =            4
   TIM(N)    =   .26298E+07           TIMV      =   .65745E+06
SUMTCH =   .55226E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1           5   12



0          .0          500.0            .000

1        70.7             .2           1.687

2        70.7             .2           1.708
```

```
3          70.7             .2           1.729

4          70.7             .2           1.750
0                      OBS.WELL NO.    X     Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           2           5    16


0            .0          500.0            .000

1          69.6             .1           1.687

2          69.6             .1           1.708

3          69.6             .1           1.729

4          69.6             .1           1.750
0                      OBS.WELL NO.    X     Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           3           5    17


0            .0          500.0            .000

1          70.5             .0           1.687

2          70.5             .0           1.708

3          70.5             .0           1.729

4          70.5             .0           1.750
0                      OBS.WELL NO.    X     Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           4           4    17


0            .0          500.0            .000

1          70.5             .0           1.687

2          70.5             .0           1.708

3          70.5             .0           1.729

4          70.5             .0           1.750
0                      OBS.WELL NO.    X     Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)
```

```
                        5           4   14


0           .0          500.0          .000

1         69.3            1.6         1.687

2         69.3            1.5         1.708

3         69.3            1.9         1.729

4         69.3            1.4         1.750
0

   N =    22
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP       =          4137         IMOV      =            1
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .55883E+08
0  NP       =          4137         IMOV      =            2
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .56541E+08
0  NP       =          4248         IMOV      =            3
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .57198E+08
0  NP       =          4248         IMOV      =            4
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .57856E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                     OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                        1           5   12
```

0	.0	500.0	.000
1	70.7	.2	1.771
2	70.7	.2	1.792
3	70.7	.2	1.812
4	70.7	.1	1.833

```
0                        OBS.WELL NO.     X     Y
N      HEAD (FT)      CONC.(MG/L)      TIME  (YEARS)

                            2              5    16
```

0	.0	500.0	.000
1	69.6	.1	1.771
2	69.6	.1	1.792
3	69.6	.1	1.812
4	69.6	.1	1.833

```
0                        OBS.WELL NO.     X     Y
N      HEAD (FT)      CONC.(MG/L)      TIME  (YEARS)

                            3              5    17
```

0	.0	500.0	.000
1	70.5	.0	1.771
2	70.5	.0	1.792
3	70.5	.0	1.812
4	70.5	.0	1.833

```
0                        OBS.WELL NO.     X     Y
N      HEAD (FT)      CONC.(MG/L)      TIME  (YEARS)

                            4              4    17
```

0	.0	500.0	.000
1	70.5	.0	1.771

```
2          70.5              .0          1.792

3          70.5              .0          1.812

4          70.5              .0          1.833
0                       OBS.WELL NO.    X     Y
N      HEAD (FT)     CONC.(MG/L)    TIME  (YEARS)

                             5          4    14



0            .0          500.0           .000

1          69.3            1.7          1.771

2          69.3            1.2          1.792

3          69.3            1.2          1.812

4          69.3            1.3          1.833
0

   N =   23
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP       =           4312          IMOV      =           1
   TIM(N)   =    .26298E+07          TIMV      =    .65745E+06
SUMTCH =   .58513E+08
0  NP       =           4370          IMOV      =           2
   TIM(N)   =    .26298E+07          TIMV      =    .65745E+06
SUMTCH =   .59170E+08
0  NP       =           4410          IMOV      =           3
   TIM(N)   =    .26298E+07          TIMV      =    .65745E+06
SUMTCH =   .59828E+08
0  NP       =           4410          IMOV      =           4
   TIM(N)   =    .26298E+07          TIMV      =    .65745E+06
SUMTCH =   .60485E+08
1Emerson Electric--Altamonte Springs, Florida


0    TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION
```

```
0                      OBS.WELL NO.    X     Y
N     HEAD (FT)       CONC.(MG/L)     TIME (YEARS)

                           1           5    12


0         .0           500.0            .000

1       70.7              .1           1.854

2       70.7              .1           1.875

3       70.7              .1           1.896

4       70.7              .1           1.917
0                      OBS.WELL NO.    X     Y
N     HEAD (FT)       CONC.(MG/L)     TIME (YEARS)

                           2           5    16


0         .0           500.0            .000

1       69.6              .1           1.854

2       69.6              .1           1.875

3       69.6              .1           1.896

4       69.6              .1           1.917
0                      OBS.WELL NO.    X     Y
N     HEAD (FT)       CONC.(MG/L)     TIME (YEARS)

                           3           5    17


0         .0           500.0            .000

1       70.5              .0           1.854

2       70.5              .0           1.875

3       70.5              .0           1.896

4       70.5              .0           1.917
0                      OBS.WELL NO.    X     Y
N     HEAD (FT)       CONC.(MG/L)     TIME (YEARS)
```

```
                                   4           4   17


0            .0            500.0           .000

1          70.5               .0          1.854

2          70.5               .0          1.875

3          70.5               .0          1.896

4          70.5               .0          1.917
0                       OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                                   5           4   14


0            .0            500.0           .000

1          69.3              1.1          1.854

2          69.3              1.0          1.875

3          69.3              1.0          1.896

4          69.3              1.0          1.917
0

   N =   24
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP        =          4553          IMOV      =           1
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .61143E+08
0  NP        =          4553          IMOV      =           2
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .61800E+08
0  NP        =          4563          IMOV      =           3
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .62458E+08
0  NP        =          4621          IMOV      =           4
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .63115E+08
1Emerson Electric--Altamonte Springs, Florida
```

```
0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                 STEADY-STATE SOLUTION



0                          OBS.WELL NO.     X     Y
N       HEAD (FT)        CONC.(MG/L)      TIME  (YEARS)

                               1           5    12


0            .0            500.0             .000

1          70.7               .1            1.937

2          70.7               .1            1.958

3          70.7               .1            1.979

4          70.7               .1            2.000
0                          OBS.WELL NO.     X     Y
N       HEAD (FT)        CONC.(MG/L)      TIME  (YEARS)

                               2           5    16


0            .0            500.0             .000

1          69.6               .0            1.937

2          69.6               .1            1.958

3          69.6               .1            1.979

4          69.6               .0            2.000
0                          OBS.WELL NO.     X     Y
N       HEAD (FT)        CONC.(MG/L)      TIME  (YEARS)

                               3           5    17


0            .0            500.0             .000
```

```
1          70.5              .0          1.937

2          70.5              .0          1.958

3          70.5              .0          1.979

4          70.5              .0          2.000
0                   OBS.WELL NO.     X     Y
N       HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         4           4    17


0            .0           500.0           .000

1          70.5              .0          1.937

2          70.5              .0          1.958

3          70.5              .0          1.979

4          70.5              .0          2.000
0                   OBS.WELL NO.     X     Y
N       HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         5           4    14


0            .0           500.0           .000

1          69.3              .9          1.937

2          69.3              .9          1.958

3          69.3              .7          1.979

4          69.3             1.0          2.000
0

   N =   25
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0  NP       =          4692         IMOV      =            1
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .63773E+08
0  NP       =          4692         IMOV      =            2
   TIM(N)   =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =   .64430E+08
```

```
0   NP         =          4803           IMOV      =            3
    TIM(N)     =    .26298E+07           TIMV      =    .65745E+06
SUMTCH =    .65088E+08
0   NP         =          4803           IMOV      =            4
    TIM(N)     =    .26298E+07           TIMV      =    .65745E+06
SUMTCH =    .65745E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

                PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.     X     Y
N      HEAD  (FT)     CONC.(MG/L)     TIME  (YEARS)

                            1          5    12


0          .0          500.0             .000

1        70.7             .1            2.021

2        70.7             .1            2.042

3        70.7             .1            2.062

4        70.7             .1            2.083
0                      OBS.WELL NO.     X     Y
N      HEAD  (FT)     CONC.(MG/L)     TIME  (YEARS)

                            2          5    16


0          .0          500.0             .000

1        69.6             .1            2.021

2        69.6             .0            2.042

3        69.6             .0            2.062

4        69.6             .0            2.083
```

```
0                       OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)

                             3            5    17



0           .0          500.0            .000

1         70.5             .0           2.021

2         70.5             .0           2.042

3         70.5             .0           2.062

4         70.5             .0           2.083
0                       OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)

                             4            4    17



0           .0          500.0            .000

1         70.5             .0           2.021

2         70.5             .0           2.042

3         70.5             .0           2.062

4         70.5             .0           2.083
0                       OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)

                             5            4    14



0           .0          500.0            .000

1         69.3             .9           2.021

2         69.3             .7           2.042

3         69.3             .7           2.062

4         69.3             .7           2.083
0

   N =    26
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4
```

```
0  NP        =          4843          IMOV     =           1
   TIM(N)    =    .26298E+07          TIMV     =  .65745E+06
SUMTCH =    .66402E+08
0  NP        =          4893          IMOV     =           2
   TIM(N)    =    .26298E+07          TIMV     =  .65745E+06
SUMTCH =    .67060E+08
0  NP        =          4921          IMOV     =           3
   TIM(N)    =    .26298E+07          TIMV     =  .65745E+06
SUMTCH =    .67717E+08
0  NP        =          4921          IMOV     =           4
   TIM(N)    =    .26298E+07          TIMV     =  .65745E+06
SUMTCH =    .68375E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            1          5   12



0          .0           500.0          .000

1        70.7              .1         2.104

2        70.7              .1         2.125

3        70.7              .1         2.146

4        70.7              .1         2.167
0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            2          5   16



0          .0           500.0          .000
```

```
1          69.6          .0        2.104

2          69.6          .0        2.125

3          69.6          .0        2.146

4          69.6          .0        2.167
0                   OBS.WELL NO.     X    Y
N       HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                         3           5   17


0            .0       500.0         .000

1          70.5          .0        2.104

2          70.5          .0        2.125

3          70.5          .0        2.146

4          70.5          .0        2.167
0                   OBS.WELL NO.     X    Y
N       HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                         4           4   17


0            .0       500.0         .000

1          70.5          .0        2.104

2          70.5          .0        2.125

3          70.5          .0        2.146

4          70.5          .0        2.167
0                   OBS.WELL NO.     X    Y
N       HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                         5           4   14


0            .0       500.0         .000

1          69.3          .6        2.104

2          69.3          .7        2.125

3          69.3          .8        2.146
```

```
4          69.3               .5          2.167
0

   N =    27
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP   =     4


0  NP        =           5071          IMOV     =            1
   TIM(N)    =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .69032E+08
0  NP        =           5071          IMOV     =            2
   TIM(N)    =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .69690E+08
0  NP        =           5079          IMOV     =            3
   TIM(N)    =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .70347E+08
0  NP        =           5110          IMOV     =            4
   TIM(N)    =   .26298E+07          TIMV     =   .65745E+06
SUMTCH =   .71005E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                           1           5   12


0           .0          500.0           .000

1         70.7             .1          2.188

2         70.7             .1          2.208

3         70.7             .1          2.229

4         70.7             .0          2.250
```

```
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         2            5   16


0          .0          500.0             .000

1        69.6             .0            2.188

2        69.6             .0            2.208

3        69.6             .0            2.229

4        69.6             .0            2.250
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         3            5   17


0          .0          500.0             .000

1        70.5             .0            2.188

2        70.5             .0            2.208

3        70.5             .0            2.229

4        70.5             .0            2.250
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         4            4   17


0          .0          500.0             .000

1        70.5             .0            2.188

2        70.5             .0            2.208

3        70.5             .0            2.229

4        70.5             .0            2.250
0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         5            4   14
```

```
0             .0           500.0            .000

1           69.3              .5           2.188

2           69.3              .5           2.208

3           69.3              .5           2.229

4           69.3              .4           2.250
0

   N =   28
   NUMBER OF ITERATIONS = 0   (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    4


0      ***   NOTE   ***          NPTM.EQ.NPMAX --- IMOV=   1
PT. NO.=4880     CALL GENPT

0  NP        =          4032        IMOV     =           1
   TIM(N)    =   .26298E+07         TIMV     =    .65745E+06
SUMTCH =   .71662E+08
0  NP        =          4036        IMOV     =           2
   TIM(N)    =   .26298E+07         TIMV     =    .65745E+06
SUMTCH =   .72319E+08
0  NP        =          4077        IMOV     =           3
   TIM(N)    =   .26298E+07         TIMV     =    .65745E+06
SUMTCH =   .72977E+08
0  NP        =          4137        IMOV     =           4
   TIM(N)    =   .26298E+07         TIMV     =    .65745E+06
SUMTCH =   .73634E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                       OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)

                             1           5    12
```

```
0          .0          500.0          .000

1        70.7             .0         2.271

2        70.7             .0         2.292

3        70.7             .0         2.312

4        70.7             .0         2.333
0                   OBS.WELL NO.     X     Y
N      HEAD (FT)   CONC.(MG/L)    TIME  (YEARS)

                         2           5    16


0          .0          500.0          .000

1        69.6             .0         2.271

2        69.6             .0         2.292

3        69.6             .0         2.312

4        69.6             .0         2.333
0                   OBS.WELL NO.     X     Y
N      HEAD (FT)   CONC.(MG/L)    TIME  (YEARS)

                         3           5    17


0          .0          500.0          .000

1        70.5             .0         2.271

2        70.5             .0         2.292

3        70.5             .0         2.312

4        70.5             .0         2.333
0                   OBS.WELL NO.     X     Y
N      HEAD (FT)   CONC.(MG/L)    TIME  (YEARS)

                         4           4    17


0          .0          500.0          .000

1        70.5             .0         2.271
```

```
2          70.5              .0         2.292

3          70.5              .0         2.312

4          70.5              .0         2.333
0                     OBS.WELL NO.     X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                           5            4    14



0           .0            500.0          .000

1          69.3              .4         2.271

2          69.3              .5         2.292

3          69.3              .4         2.312

4          69.3              .5         2.333
0

   N =    29
   NUMBER OF ITERATIONS = 0   (HEADS UNCHANGED)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP   =     4


0  NP        =          4137           IMOV      =          1
   TIM(N)    =    .26298E+07           TIMV      =    .65745E+06
SUMTCH =    .74292E+08
0  NP        =          4248           IMOV      =          2
   TIM(N)    =    .26298E+07           TIMV      =    .65745E+06
SUMTCH =    .74949E+08
0  NP        =          4248           IMOV      =          3
   TIM(N)    =    .26298E+07           TIMV      =    .65745E+06
SUMTCH =    .75607E+08
0  NP        =          4312           IMOV      =          4
   TIM(N)    =    .26298E+07           TIMV      =    .65745E+06
SUMTCH =    .76264E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION
```

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)
		1	5 12
0	.0	500.0	.000
1	70.7	.0	2.354
2	70.7	.0	2.375
3	70.7	.0	2.396
4	70.7	.0	2.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.0	2.354
2	69.6	.0	2.375
3	69.6	.0	2.396
4	69.6	.0	2.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.0	2.354
2	70.5	.0	2.375
3	70.5	.0	2.396
4	70.5	.0	2.417

0 N	HEAD (FT)	OBS.WELL NO. CONC.(MG/L)	X Y TIME (YEARS)

```
                        4           4    17


0          .0          500.0           .000

1        70.5             .0          2.354

2        70.5             .0          2.375

3        70.5             .0          2.396

4        70.5             .0          2.417
0                   OBS.WELL NO.     X     Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                        5           4    14


0          .0          500.0           .000

1        69.3             .3          2.354

2        69.3             .3          2.375

3        69.3             .4          2.396

4        69.3             .3          2.417
0

   N =    30
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1HEAD DISTRIBUTION - ROW
 NUMBER OF TIME STEPS =     30
        TIME(SECONDS) =   .78894E+08
        TIME(DAYS)    =   .91313E+03
        TIME(YEARS)   =   .25000E+01

0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000  79.2999994  79.4999987  79.7999976
79.9999984  80.2999982  80.6999971  80.9999971  81.1999980
81.4999971
0  81.6999975  81.8999975  82.0999979  82.3999967
82.5999960    .0000000
0    .0000000  78.9265185  79.0480937  79.2468366
79.4634507  79.7294283  80.0337620  80.3148523  80.5638194
80.8188506
```

```
0  81.0404362   81.2447167   81.4370573   81.6252401
81.7428559     .0000000
0    .0000000   78.4320454   78.5199398   78.6764891
78.8782103  79.1211735  79.3914359  79.6624918  79.9222375
80.1718154
0  80.3988512   80.6020463   80.7789590   80.9219693
81.0039144     .0000000
0    .0000000   77.8491373   77.9223626   78.0603171
78.2511133  78.4850021  78.7477015  79.0208304  79.2902124
79.5467077
0  79.7804892   79.9850440   80.1541104   80.2789955
80.3463774     .0000000
0    .0000000   77.1929227   77.2599779   77.3912231
77.5808728  77.8199709  78.0934854  78.3828621  78.6710203
78.9442616
0  79.1913047   79.4034795   79.5733625   79.6934469
79.7561409     .0000000
0    .0000000   76.4700565   76.5340835   76.6642013
76.8616750  77.1210108  77.4238882  77.7465895  78.0672224
78.3684947
0  78.6374760   78.8646977   79.0428900   79.1659689
79.2290020     .0000000
0    .0000000   75.6828437   75.7417242   75.8694236
76.0802626  76.3781526  76.7341085  77.1120282  77.4824277
77.8246606
0  78.1250502   78.3745932   78.5671307   78.6981627
78.7645767     .0000000
0    .0000000   74.8366361   74.8804766   74.9913755
75.2117167  75.5771464  76.0222783  76.4848983  76.9257105
77.3225829
0  77.6633891   77.9414113   78.1527463   78.2949050
78.3664511     .0000000
0    .0000000   73.9467594   73.9525242   74.0040900
74.1983258  74.6966765  75.2931925  75.8798064  76.4131634
76.8768038
0  77.2647507   77.5751600   77.8077431   77.9626136
78.0400428     .0000000
0    .0000000   73.0509665   72.9786682   72.8739453
72.8806827  73.7179023  74.5738648  75.3278264  75.9701877
76.5065745
0  76.9435108   77.2865978   77.5402631   77.7076610
77.7909125     .0000000
0    .0000000   72.2273200   72.0371322   71.6321507
70.7324201  72.7202459  73.9563940  74.8873014  75.6330413
76.2356514
0  76.7159809   77.0873201   77.3588610   77.5367500
77.6248818     .0000000
0    .0000000   71.5940287   71.3107372   70.8853060
71.2523959  72.4745017  73.6443922  74.6321701  75.4392509
76.0872373
0  76.5976757   76.9880801   77.2713113   77.4559436
77.5471504     .0000000
```

```
0    .0000000  71.2439203  70.7264211  69.3458157
70.9172792  72.2808969  73.5144223  74.5576529  75.4044719
76.0762902
0  76.5993285  76.9959367  77.2822361  77.4685018
77.5605170    .0000000
0    .0000000  71.4109963  71.0048448  70.4094179
70.7896617  72.2170339  73.5743945  74.6791959  75.5443423
76.2137707
0  76.7270609  77.1137557  77.3928003  77.5749443
77.6655840    .0000000
0    .0000000  71.9846137  71.4732039  70.4978099
69.6153911  72.2236546  73.8873913  75.0408561  75.8803926
76.5078548
0  76.9818607  77.3397005  77.6007253  77.7735513
77.8616806    .0000000
0    .0000000  73.0695625  72.4054739  70.4931491
70.5059457  73.1747555  74.7106105  75.7163934  76.4284659
76.9553456
0  77.3527802  77.6624119  77.8967716  78.0567816
78.1458280    .0000000
0    .0000000  74.8180742  74.5852333  74.1182878
74.2954452  75.2582108  76.0633040  76.6850471  77.1611377
77.5316839
0  77.8109020  78.0597982  78.2665328  78.4102291
78.5184959    .0000000
0    .0000000  76.7999933  76.9999906  77.0999892
77.2999888  77.4999912  77.5999946  77.7999958  77.9999969
78.1999971
0  78.2999985  78.4999984  78.6999980  78.7999989
78.9999974    .0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
1HEAD DISTRIBUTION - ROW
 NUMBER OF TIME STEPS =     30
         TIME(SECONDS) =   .78894E+08
         TIME(DAYS)    =   .91313E+03
         TIME(YEARS)   =   .25000E+01

0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
0   0
0   0  79  79  80  80  80  81  81  81  81  82  82  82  82
83   0
0   0  79  79  79  79  80  80  80  81  81  81  81  81  82
82   0
0   0  78  79  79  79  79  79  80  80  80  80  81  81  81
81   0
0   0  78  78  78  78  78  79  79  79  80  80  80  80  80
80   0
0   0  77  77  77  78  78  78  78  79  79  79  79  80  80
80   0
```

```
0    0   76   77   77   77   77   77   78   78   78   79   79   79   79
79   0
0    0   76   76   76   76   76   77   77   77   78   78   78   79   79
79   0
0    0   75   75   75   75   76   76   76   77   77   78   78   78   78
78   0
0    0   74   74   74   74   75   75   76   76   77   77   78   78   78
78   0
0    0   73   73   73   73   74   75   75   76   77   77   77   78   78
78   0
0    0   72   72   72   71   73   74   75   76   76   77   77   77   78
78   0
0    0   72   71   71   71   72   74   75   75   76   77   77   77   77
78   0
0    0   71   71   69   71   72   74   75   75   76   77   77   77   77
78   0
0    0   71   71   70   71   72   74   75   76   76   77   77   77   78
78   0
0    0   72   71   70   70   72   74   75   76   77   77   77   78   78
78   0
0    0   73   72   70   71   73   75   76   76   77   77   78   78   78
78   0
0    0   75   75   74   74   75   76   77   77   78   78   78   78   78
79   0
0    0   77   77   77   77   77   78   78   78   78   78   78   79   79
79   0
0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0    0
1DRAWDOWN
            0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0
            0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0
            0   -79   -79   -79   -79   -80   -80   -80   -81   -81   -81
-81   -81   -82   -82     0
            0   -78   -79   -79   -79   -79   -79   -80   -80   -80   -80
-81   -81   -81   -81     0
            0   -78   -78   -78   -78   -78   -79   -79   -79   -80   -80
-80   -80   -80   -80     0
            0   -77   -77   -77   -78   -78   -78   -78   -79   -79   -79
-79   -80   -80   -80     0
            0   -76   -77   -77   -77   -77   -77   -78   -78   -78   -79
-79   -79   -79   -79     0
            0   -76   -76   -76   -76   -76   -77   -77   -77   -78   -78
-78   -79   -79   -79     0
            0   -75   -75   -75   -75   -76   -76   -76   -77   -77   -78
-78   -78   -78   -78     0
            0   -74   -74   -74   -74   -75   -75   -76   -76   -77   -77
-78   -78   -78   -78     0
            0   -73   -73   -73   -73   -74   -75   -75   -76   -77   -77
-77   -78   -78   -78     0
            0   -72   -72   -72   -71   -73   -74   -75   -76   -76   -77
-77   -77   -78   -78     0
```

```
      0  -72  -71  -71  -71  -72  -74  -75  -75  -76  -77
-77  -77  -77  -78    0
      0  -71  -71  -69  -71  -72  -74  -75  -75  -76  -77
-77  -77  -77  -78    0
      0  -71  -71  -70  -71  -72  -74  -75  -76  -76  -77
-77  -77  -78  -78    0
      0  -72  -71  -70  -70  -72  -74  -75  -76  -77  -77
-77  -78  -78  -78    0
      0  -73  -72  -70  -71  -73  -75  -76  -76  -77  -77
-78  -78  -78  -78    0
      0  -75  -75  -74  -74  -75  -76  -77  -77  -78  -78
-78  -78  -78  -79    0
      0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
      0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0  CUMULATIVE MASS BALANCE -- (IN FT**3)


    RECHARGE AND INJECTION       =   .00000E+00
    PUMPAGE AND E-T WITHDRAWAL =   .51281E+07
    CUMULATIVE  NET  PUMPAGE     =   .51281E+07
    WATER RELEASE FROM STORAGE =   .00000E+00
    LEAKAGE INTO AQUIFER         =   .51288E+07
    LEAKAGE OUT OF AQUIFER       =   .00000E+00
    CUMULATIVE  NET  LEAKAGE     =   .51288E+07
0       MASS BALANCE RESIDUAL    =   704.80
        ERROR  (AS PERCENT)      =   .13743E-01

0  RATE MASS BALANCE -- (IN C.F.S.)


    LEAKAGE INTO AQUIFER         =   .65009E-01
    LEAKAGE OUT OF AQUIFER       =   .00000E+00
    NET LEAKAGE     (QNET)       =   .65009E-01
    RECHARGE AND INJECTION       =   .00000E+00
    PUMPAGE AND E-T WITHDRAWAL =   .65000E-01
    NET WITHDRAWAL    (TPUM)     =   .65000E-01
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP   =    4


0  NP        =          4370          IMOV      =           1
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =    .76922E+08
0  NP        =          4410          IMOV      =           2
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =    .77579E+08
0  NP        =          4410          IMOV      =           3
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =    .78237E+08
0  NP        =          4553          IMOV      =           4
   TIM(N)    =   .26298E+07          TIMV      =   .65745E+06
SUMTCH =    .78894E+08
```

```
1CONCENTRATION

 NUMBER OF TIME STEPS =     30
        DELTA T       =    .26298E+07
        TIME(SECONDS) =    .78894E+08
   CHEM.TIME(SECONDS) =    .78894E+08
   CHEM.TIME(DAYS)    =    .91312E+03
        TIME(YEARS)   =    .25000E+01
   CHEM.TIME(YEARS)   =    .25000E+01
  NO. MOVES COMPLETED =      4

0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    1    1    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0

 CHEMICAL MASS BALANCE
```

```
          MASS IN BOUNDARIES        =    .00000E+00
          MASS OUT BOUNDARIES       =    .00000E+00
          MASS PUMPED IN            =    .00000E+00
          MASS PUMPED OUT           =  -.10464E+09
          MASS LOST BY DECAY        =    .00000E+00
          MASS ADSORBED ON SOLIDS=       .16301E+05
          INITIAL MASS ADSORBED     =    .29182E+08
          INFLOW MINUS OUTFLOW      =  -.10464E+09
          INITIAL MASS DISSOLVED =       .83377E+08
          PRESENT MASS DISSOLVED =       .46575E+05
          CHANGE MASS DISSOLVED     =  -.83330E+08
          CHANGE TOTL.MASS STORED=     -.11250E+09
        COMPARE RESIDUAL WITH NET FLUX AND MASS ACCUMULATION:
          MASS BALANCE RESIDUAL     =    .78585E+07
          ERROR   (AS PERCENT)      =    .00000E+00
        COMPARE INITIAL MASS STORED WITH CHANGE IN MASS
STORED:
          ERROR   (AS PERCENT)      =  -.36181E+01
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    1



0                STEADY-STATE SOLUTION



0                     OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)     TIME (YEARS)

                           1           5   12



0          .0          500.0            .000

1        70.7             .0           2.438

2        70.7             .0           2.458

3        70.7             .0           2.479

4        70.7             .0           2.500
0                     OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)     TIME (YEARS)

                           2           5   16
```

0	.0	500.0	.000
1	69.6	.0	2.438
2	69.6	.0	2.458
3	69.6	.0	2.479
4	69.6	.0	2.500

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		3	5	17

0	.0	500.0	.000
1	70.5	.0	2.438
2	70.5	.0	2.458
3	70.5	.0	2.479
4	70.5	.0	2.500

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		4	4	17

0	.0	500.0	.000
1	70.5	.0	2.438
2	70.5	.0	2.458
3	70.5	.0	2.479
4	70.5	.0	2.500

0		OBS.WELL NO.	X	Y
N	HEAD (FT)	CONC.(MG/L)	TIME	(YEARS)
		5	4	14

0	.0	500.0	.000
1	69.3	.3	2.438

```
2         69.3              .3          2.458

3         69.3              .3          2.479

4         69.3              .2          2.500
1     START PUMPING PERIOD NO.  2

  THE FOLLOWING TIME STEP, PUMPAGE, AND PRINT PARAMETERS
HAVE BEEN REDEFINED:

0              NTIM    =   30
               NPNT    =   30
               NITP    =    7
               ITMAX   =  100
               NREC    =    5
               NPNTMV  =    0
               NPNTVL  =    0
               NPNTD   =    0
               NPDELC  =    0
               NPNCHV  =    0
               PINT    =        .900
               TIMX    =       1.000
               TINIT   =        .000

1                   STEADY-STATE FLOW

     TIME INTERVALS (IN SEC) FOR SOLUTE-TRANSPORT SIMULATION
     .94673E+06   .94673E+06   .94673E+06   .94673E+06
.94673E+06   .94673E+06   .94673E+06   .94673E+06   .94673E+06
.94673E+06
     .94673E+06   .94673E+06   .94673E+06   .94673E+06
.94673E+06   .94673E+06   .94673E+06   .94673E+06   .94673E+06
.94673E+06
     .94673E+06   .94673E+06   .94673E+06   .94673E+06
.94673E+06   .94673E+06   .94673E+06   .94673E+06   .94673E+06
.94673E+06

0          LOCATION  OF  PUMPING  WELLS

           X   Y   RATE(IN CFS)   CONC.

           5  12       .0130        .00
           5  16       .0130        .00
           5  17       .0130        .00
           4  17       .0130        .00
           4  14       .0130        .00
0

   N =    1
   NUMBER OF ITERATIONS =     5
1          STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =    .21003E+07
  TIMV (CELDIS)    =    .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =    .94673E+06
   TIMEVELO =    .47336E+06
   TIMEDISP =    .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4553          IMOV      =          1
   TIM(N)    =    .94673E+06          TIMV      =   .47336E+06
SUMTCH =    .79367E+08
0  NP        =          4553          IMOV      =          2
   TIM(N)    =    .94673E+06          TIMV      =   .47336E+06
SUMTCH =    .79841E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                 STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME  (YEARS)

                            1          5   12


0           .0        500.0           .000

1         70.7           .0          2.515

2         70.7           .0          2.530
```

```
0                       OBS.WELL NO.      X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                             2             5    16



0             .0          500.0            .000

1           69.6             .0           2.515

2           69.6             .0           2.530
0                       OBS.WELL NO.      X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                             3             5    17



0             .0          500.0            .000

1           70.5             .0           2.515

2           70.5             .0           2.530
0                       OBS.WELL NO.      X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                             4             4    17



0             .0          500.0            .000

1           70.5             .0           2.515

2           70.5             .0           2.530
0                       OBS.WELL NO.      X     Y
N       HEAD (FT)     CONC.(MG/L)     TIME (YEARS)

                             5             4    14



0             .0          500.0            .000

1           69.3             .2           2.515

2           69.3             .2           2.530
0

   N =      2
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1            STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)  =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          4600          IMOV     =          1
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .80314E+08
0  NP       =          4634          IMOV     =          2
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .80787E+08
1Emerson Electric--Altamonte Springs, Florida


0    TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12



0          .0         500.0           .000

1        70.7            .0          2.545

2        70.7            .0          2.560
```

```
0                           OBS.WELL NO.     X    Y
N      HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                                 2           5   16


0          .0           500.0             .000

1        69.6              .0            2.545

2        69.6              .0            2.560
0                           OBS.WELL NO.     X    Y
N      HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                                 3           5   17


0          .0           500.0             .000

1        70.5              .0            2.545

2        70.5              .0            2.560
0                           OBS.WELL NO.     X    Y
N      HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                                 4           4   17


0          .0           500.0             .000

1        70.5              .0            2.545

2        70.5              .0            2.560
0                           OBS.WELL NO.     X    Y
N      HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                                 5           4   14


0          .0           500.0             .000

1        69.3              .2            2.545

2        69.3              .3            2.560
0

   N =      3
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =         4662          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .81261E+08
0  NP        =         4726          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .81734E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                     OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                           1          5   12


0          .0         500.0          .000

1        70.7            .0         2.575

2        70.7            .0         2.590
```

```
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         2          5   16



0          .0         500.0            .000

1        69.6            .0           2.575

2        69.6            .0           2.590
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         3          5   17



0          .0         500.0            .000

1        70.5            .0           2.575

2        70.5            .0           2.590
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         4          4   17



0          .0         500.0            .000

1        70.5            .0           2.575

2        70.5            .0           2.590
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                         5          4   14



0          .0         500.0            .000

1        69.3            .3           2.575

2        69.3            .2           2.590
0

   N =     4
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)  =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          4726          IMOV     =            1
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .82208E+08
0  NP       =          4749          IMOV     =            2
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .82681E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                    OBS.WELL NO.     X    Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1           5    12


0         .0         500.0          .000

1        70.7           .0         2.605

2        70.7           .0         2.620
```

```
0                    OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)     TIME (YEARS)

                         2           5   16



0          .0          500.0            .000

1        69.6             .0           2.605

2        69.6             .0           2.620
0                    OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)     TIME (YEARS)

                         3           5   17



0          .0          500.0            .000

1        70.5             .0           2.605

2        70.5             .0           2.620
0                    OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)     TIME (YEARS)

                         4           4   17



0          .0          500.0            .000

1        70.5             .0           2.605

2        70.5             .0           2.620
0                    OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)     TIME (YEARS)

                         5           4   14



0          .0          500.0            .000

1        69.3             .2           2.605

2        69.3             .2           2.620
0

   N =     5
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)  =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4839          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .83154E+08
0  NP        =          4856          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .83628E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                  OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                         1          5   12


0          .0          500.0          .000

1        70.7             .0         2.635

2        70.7             .0         2.650
```

```
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        2          5   16


0         .0         500.0           .000

1       69.6            .0          2.635

2       69.6            .0          2.650
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        3          5   17


0         .0         500.0           .000

1       70.5            .0          2.635

2       70.5            .0          2.650
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        4          4   17


0         .0         500.0           .000

1       70.5            .0          2.635

2       70.5            .0          2.650
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        5          4   14


0         .0         500.0           .000

1       69.3            .2          2.635

2       69.3            .2          2.650
0

   N =     6
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4856          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .84101E+08
0  NP        =          4939          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .84574E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                    OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         1          5   12


0        .0          500.0          .000

1       70.7           .0          2.665

2       70.7           .0          2.680
```

```
0                  OBS.WELL NO.     X     Y
N       HEAD (FT)    CONC.(MG/L)     TIME  (YEARS)

                          2            5    16


0          .0           500.0              .000

1        69.6              .0             2.665

2        69.6              .0             2.680
0                  OBS.WELL NO.     X     Y
N       HEAD (FT)    CONC.(MG/L)     TIME  (YEARS)

                          3            5    17


0          .0           500.0              .000

1        70.5              .0             2.665

2        70.5              .0             2.680
0                  OBS.WELL NO.     X     Y
N       HEAD (FT)    CONC.(MG/L)     TIME  (YEARS)

                          4            4    17


0          .0           500.0              .000

1        70.5              .0             2.665

2        70.5              .0             2.680
0                  OBS.WELL NO.     X     Y
N       HEAD (FT)    CONC.(MG/L)     TIME  (YEARS)

                          5            4    14


0          .0           500.0              .000

1        69.3              .2             2.665

2        69.3              .2             2.680
0

   N =     7
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          4939          IMOV     =          1
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .85048E+08
0  NP       =          4939          IMOV     =          2
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .85521E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                       OBS.WELL NO.    X    Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                              1         5   12


0           .0          500.0           .000

1         70.7            .0           2.695

2         70.7            .0           2.710
```

```
0                          OBS.WELL NO.     X     Y
N       HEAD (FT)       CONC.(MG/L)      TIME (YEARS)

                                2            5    16



0            .0           500.0                .000

1          69.6              .0               2.695

2          69.6              .0               2.710
0                          OBS.WELL NO.     X     Y
N       HEAD (FT)       CONC.(MG/L)      TIME (YEARS)

                                3            5    17



0            .0           500.0                .000

1          70.5              .0               2.695

2          70.5              .0               2.710
0                          OBS.WELL NO.     X     Y
N       HEAD (FT)       CONC.(MG/L)      TIME (YEARS)

                                4            4    17



0            .0           500.0                .000

1          70.5              .0               2.695

2          70.5              .0               2.710
0                          OBS.WELL NO.     X     Y
N       HEAD (FT)       CONC.(MG/L)      TIME (YEARS)

                                5            4    14



0            .0           500.0                .000

1          69.3              .2               2.695

2          69.3              .2               2.710
0

   N =     8
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP         =          5004          IMOV     =           1
   TIM(N)     =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .85994E+08
0  NP         =          5043          IMOV     =           2
   TIM(N)     =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .86468E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION




0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12



0          .0        500.0           .000

1        70.7          .0          2.725

2        70.7          .0          2.740
```

```
0                        OBS.WELL NO.     X     Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                             2            5    16



0           .0           500.0             .000

1         69.6              .0            2.725

2         69.6              .0            2.740
0                        OBS.WELL NO.     X     Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                             3            5    17



0           .0           500.0             .000

1         70.5              .0            2.725

2         70.5              .0            2.740
0                        OBS.WELL NO.     X     Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                             4            4    17



0           .0           500.0             .000

1         70.5              .0            2.725

2         70.5              .0            2.740
0                        OBS.WELL NO.     X     Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                             5            4    14



0           .0           500.0             .000

1         69.3              .1            2.725

2         69.3              .1            2.740
0

   N =      9
   NUMBER OF ITERATIONS = 0   (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          5043          IMOV      =          1
   TIM(N)    =   .94673E+06           TIMV      =   .47336E+06
SUMTCH =   .86941E+08
0  NP        =          5134          IMOV      =          2
   TIM(N)    =   .94673E+06           TIMV      =   .47336E+06
SUMTCH =   .87415E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12


0          .0         500.0          .000

1        70.7           .0          2.755

2        70.7           .0          2.770
```

```
0                     OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            2          5   16


0         .0          500.0            .000

1       69.6             .0           2.755

2       69.6             .0           2.770
0                     OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            3          5   17


0         .0          500.0            .000

1       70.5             .0           2.755

2       70.5             .0           2.770
0                     OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            4          4   17


0         .0          500.0            .000

1       70.5             .0           2.755

2       70.5             .0           2.770
0                     OBS.WELL NO.    X    Y
N      HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                            5          4   14


0         .0          500.0            .000

1       69.3             .1           2.755

2       69.3             .1           2.770
0

   N =   10
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.
```

```
0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)  =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          5134         IMOV     =           1
   TIM(N)   =    .94673E+06         TIMV     =    .47336E+06
SUMTCH =   .87888E+08
0      ***   NOTE   ***          NPTM.EQ.NPMAX --- IMOV=   2
PT. NO.=1993     CALL GENPT

0  NP       =          4032         IMOV     =           2
   TIM(N)   =    .94673E+06         TIMV     =    .47336E+06
SUMTCH =   .88361E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12


0          .0         500.0          .000
```

```
1        70.7          .0          2.785

2        70.7          .0          2.800
0                OBS.WELL NO.    X     Y
N     HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                      2          5    16


0          .0        500.0          .000

1        69.6          .0          2.785

2        69.6          .0          2.800
0                OBS.WELL NO.    X     Y
N     HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                      3          5    17


0          .0        500.0          .000

1        70.5          .0          2.785

2        70.5          .0          2.800
0                OBS.WELL NO.    X     Y
N     HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                      4          4    17


0          .0        500.0          .000

1        70.5          .0          2.785

2        70.5          .0          2.800
0                OBS.WELL NO.    X     Y
N     HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                      5          4    14


0          .0        500.0          .000

1        69.3          .1          2.785

2        69.3          .1          2.800
0
```

```
   N =    11
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =    .21003E+07
  TIMV (CELDIS)   =    .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0           THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4032          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =    .88835E+08
0  NP        =          4063          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =    .89308E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

                PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N       HEAD (FT)     CONC.(MG/L)    TIME  (YEARS)

                            1          5   12


0             .0         500.0          .000
```

1 70.7 .0 2.815

2 70.7 .0 2.830
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

2 5 16

0 .0 500.0 .000

1 69.6 .0 2.815

2 69.6 .0 2.830
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

3 5 17

0 .0 500.0 .000

1 70.5 .0 2.815

2 70.5 .0 2.830
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

4 4 17

0 .0 500.0 .000

1 70.5 .0 2.815

2 70.5 .0 2.830
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

5 4 14

0 .0 500.0 .000

1 69.3 .2 2.815

2 69.3 .1 2.830
0

```
   N =   12
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4093          IMOV     =          1
   TIM(N)    =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .89781E+08
0  NP        =          4115          IMOV     =          2
   TIM(N)    =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .90255E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                          1          5   12


0           .0          500.0          .000
```

```
1        70.7            .0          2.845

2        70.7            .0          2.860
0                  OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        2          5   16



0          .0         500.0           .000

1        69.6            .0          2.845

2        69.6            .0          2.860
0                  OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        3          5   17



0          .0         500.0           .000

1        70.5            .0          2.845

2        70.5            .0          2.860
0                  OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        4          4   17



0          .0         500.0           .000

1        70.5            .0          2.845

2        70.5            .0          2.860
0                  OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        5          4   14



0          .0         500.0           .000

1        69.3            .1          2.845

2        69.3            .1          2.860
0
```

```
   N =   13
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          4187          IMOV     =          1
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .90728E+08
0  NP       =          4187          IMOV     =          2
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .91201E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12


0           .0        500.0          .000
```

```
1          70.7              .0           2.875

2          70.7              .0           2.890
0                     OBS.WELL NO.      X     Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          2            5    16


0            .0           500.0            .000

1          69.6              .0           2.875

2          69.6              .0           2.890
0                     OBS.WELL NO.      X     Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          3            5    17


0            .0           500.0            .000

1          70.5              .0           2.875

2          70.5              .0           2.890
0                     OBS.WELL NO.      X     Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          4            4    17


0            .0           500.0            .000

1          70.5              .0           2.875

2          70.5              .0           2.890
0                     OBS.WELL NO.      X     Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          5            4    14


0            .0           500.0            .000

1          69.3              .1           2.875

2          69.3              .1           2.890
0
```

```
   N =   14
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)    =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)    =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4204          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .91675E+08
0  NP        =          4282          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .92148E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12


0            .0          500.0          .000
```

```
1        70.7           .0          2.905

2        70.7           .0          2.920
0                  OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        2           5   16


0          .0        500.0           .000

1        69.6           .0          2.905

2        69.6           .0          2.920
0                  OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        3           5   17


0          .0        500.0           .000

1        70.5           .0          2.905

2        70.5           .0          2.920
0                  OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        4           4   17


0          .0        500.0           .000

1        70.5           .0          2.905

2        70.5           .0          2.920
0                  OBS.WELL NO.     X    Y
N      HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                        5           4   14


0          .0        500.0           .000

1        69.3           .1          2.905

2        69.3           .1          2.920
0
```

```
   N =   15
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP          =          4327          IMOV       =          1
   TIM(N)     =   .94673E+06          TIMV       =   .47336E+06
SUMTCH =   .92622E+08
0  NP          =          4327          IMOV       =          2
   TIM(N)     =   .94673E+06          TIMV       =   .47336E+06
SUMTCH =   .93095E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                    OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1           5   12


0          .0          500.0           .000
```

```
1        70.7              .0          2.935

2        70.7              .0          2.950
0                     OBS.WELL NO.    X     Y
N      HEAD  (FT)    CONC.(MG/L)    TIME  (YEARS)

                            2          5    16


0          .0           500.0           .000

1        69.6              .0          2.935

2        69.6              .0          2.950
0                     OBS.WELL NO.    X     Y
N      HEAD  (FT)    CONC.(MG/L)    TIME  (YEARS)

                            3          5    17


0          .0           500.0           .000

1        70.5              .0          2.935

2        70.5              .0          2.950
0                     OBS.WELL NO.    X     Y
N      HEAD  (FT)    CONC.(MG/L)    TIME  (YEARS)

                            4          4    17


0          .0           500.0           .000

1        70.5              .0          2.935

2        70.5              .0          2.950
0                     OBS.WELL NO.    X     Y
N      HEAD  (FT)    CONC.(MG/L)    TIME  (YEARS)

                            5          4    14


0          .0           500.0           .000

1        69.3              .1          2.935

2        69.3              .1          2.950
0
```

```
   N =   16
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP         =          4433          IMOV      =           1
   TIM(N)     =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .93568E+08
0  NP         =          4433          IMOV      =           2
   TIM(N)     =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .94042E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                    OBS.WELL NO.     X    Y
N       HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12


0           .0         500.0           .000
```

```
1         70.7            .0         2.965

2         70.7            .0         2.980
0                  OBS.WELL NO.    X     Y
N      HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                         2           5   16


0           .0         500.0          .000

1         69.6            .0         2.965

2         69.6            .0         2.980
0                  OBS.WELL NO.    X     Y
N      HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                         3           5   17


0           .0         500.0          .000

1         70.5            .0         2.965

2         70.5            .0         2.980
0                  OBS.WELL NO.    X     Y
N      HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                         4           4   17


0           .0         500.0          .000

1         70.5            .0         2.965

2         70.5            .0         2.980
0                  OBS.WELL NO.    X     Y
N      HEAD (FT)  CONC.(MG/L)   TIME (YEARS)

                         5           4   14


0           .0         500.0          .000

1         69.3            .1         2.965

2         69.3            .1         2.980
0
```

```
   N =    17
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05      Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0           THE LIMITING STABILITY CRITERION IS CELDIS
    MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4433          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .94515E+08
0  NP        =          4482          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .94988E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

                PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N       HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                           1           5   12


0            .0         500.0          .000
```

```
1        70.7          .0          2.995

2        70.7          .0          3.010
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        2           5   16


0          .0        500.0          .000

1        69.6          .0          2.995

2        69.6          .0          3.010
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        3           5   17


0          .0        500.0          .000

1        70.5          .0          2.995

2        70.5          .0          3.010
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        4           4   17


0          .0        500.0          .000

1        70.5          .0          2.995

2        70.5          .0          3.010
0                   OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        5           4   14


0          .0        500.0          .000

1        69.3          .1          2.995

2        69.3          .1          3.010
0
```

```
   N =   18
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)  =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4512          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .95462E+08
0  NP        =          4512          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .95935E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.   2



0               STEADY-STATE SOLUTION



0                 OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                         1         5   12


0           .0          500.0          .000
```

```
1        70.7          .0         3.025

2        70.7          .0         3.040
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        2          5   16


0          .0        500.0         .000

1        69.6          .0         3.025

2        69.6          .0         3.040
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        3          5   17


0          .0        500.0         .000

1        70.5          .0         3.025

2        70.5          .0         3.040
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        4          4   17


0          .0        500.0         .000

1        70.5          .0         3.025

2        70.5          .0         3.040
0                  OBS.WELL NO.    X    Y
N      HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        5          4   14


0          .0        500.0         .000

1        69.3          .1         3.025

2        69.3          .1         3.040
0
```

```
   N =   19
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1      NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0           THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP          =          4614          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .96408E+08
0  NP          =          4614          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .96882E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                  OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                          1          5   12



0            .0          500.0          .000
```

```
1        70.7          .0          3.055

2        70.7          .0          3.070
0                  OBS.WELL NO.    X    Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                       2           5   16


0          .0        500.0          .000

1        69.6          .0          3.055

2        69.6          .0          3.070
0                  OBS.WELL NO.    X    Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                       3           5   17


0          .0        500.0          .000

1        70.5          .0          3.055

2        70.5          .0          3.070
0                  OBS.WELL NO.    X    Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                       4           4   17


0          .0        500.0          .000

1        70.5          .0          3.055

2        70.5          .0          3.070
0                  OBS.WELL NO.    X    Y
N     HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                       5           4   14


0          .0        500.0          .000

1        69.3          .1          3.055

2        69.3          .1          3.070
0
```

```
   N =    20
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0           THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4659          IMOV      =           1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .97355E+08
0  NP        =          4721          IMOV      =           2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .97829E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

              PUMPING PERIOD NO.    2



0              STEADY-STATE SOLUTION



0                   OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12



0           .0          500.0          .000
```

```
1          70.7              .0           3.085

2          70.7              .0           3.100
0                        OBS.WELL NO.    X    Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                           2             5   16


0            .0           500.0            .000

1          69.6              .0           3.085

2          69.6              .0           3.100
0                        OBS.WELL NO.    X    Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                           3             5   17


0            .0           500.0            .000

1          70.5              .0           3.085

2          70.5              .0           3.100
0                        OBS.WELL NO.    X    Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                           4             4   17


0            .0           500.0            .000

1          70.5              .0           3.085

2          70.5              .0           3.100
0                        OBS.WELL NO.    X    Y
N       HEAD (FT)      CONC.(MG/L)     TIME (YEARS)

                           5             4   14


0            .0           500.0            .000

1          69.3              .1           3.085

2          69.3              .1           3.100
0
```

```
   N =   21
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4721          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .98302E+08
0  NP        =          4721          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .98775E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                            1          5   12


0            .0         500.0          .000
```

1	70.7	.0	3.115
2	70.7	.0	3.130
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.0	3.115
2	69.6	.0	3.130
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.0	3.115
2	70.5	.0	3.130
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		4	4 17
0	.0	500.0	.000
1	70.5	.0	3.115
2	70.5	.0	3.130
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		5	4 14
0	.0	500.0	.000
1	69.3	.1	3.115
2	69.3	.1	3.130
0			

```
   N =   22
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          4807         IMOV     =           1
   TIM(N)   =   .94673E+06         TIMV     =   .47336E+06
SUMTCH =   .99249E+08
0  NP       =          4823         IMOV     =           2
   TIM(N)   =   .94673E+06         TIMV     =   .47336E+06
SUMTCH =   .99722E+08
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12


0            .0         500.0          .000
```

1	70.7	.0	3.145
2	70.7	.0	3.160
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.0	3.145
2	69.6	.0	3.160
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.0	3.145
2	70.5	.0	3.160
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		4	4 17
0	.0	500.0	.000
1	70.5	.0	3.145
2	70.5	.0	3.160
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		5	4 14
0	.0	500.0	.000
1	69.3	.1	3.145
2	69.3	.1	3.160
0			

```
   N =   23
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4823          IMOV      =           1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10020E+09
0  NP        =          4884          IMOV      =           2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10067E+09
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                   OBS.WELL NO.     X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         1          5   12


0           .0        500.0           .000
```

1 70.7 .0 3.175

2 70.7 .0 3.190
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

2 5 16

0 .0 500.0 .000

1 69.6 .0 3.175

2 69.6 .0 3.190
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

3 5 17

0 .0 500.0 .000

1 70.5 .0 3.175

2 70.5 .0 3.190
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

4 4 17

0 .0 500.0 .000

1 70.5 .0 3.175

2 70.5 .0 3.190
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

5 4 14

0 .0 500.0 .000

1 69.3 .1 3.175

2 69.3 .1 3.190
0

```
   N =   24
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4915          IMOV      =           1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10114E+09
0  NP        =          4915          IMOV      =           2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10162E+09
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0                STEADY-STATE SOLUTION



0                   OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         1          5   12


0            .0          500.0          .000
```

```
1          70.7           .0          3.205

2          70.7           .0          3.220
0                    OBS.WELL NO.    X    Y
N       HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                          2          5   16


0            .0        500.0           .000

1          69.6           .0          3.205

2          69.6           .0          3.220
0                    OBS.WELL NO.    X    Y
N       HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                          3          5   17


0            .0        500.0           .000

1          70.5           .0          3.205

2          70.5           .0          3.220
0                    OBS.WELL NO.    X    Y
N       HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                          4          4   17


0            .0        500.0           .000

1          70.5           .0          3.205

2          70.5           .0          3.220
0                    OBS.WELL NO.    X    Y
N       HEAD (FT)   CONC.(MG/L)    TIME (YEARS)

                          5          4   14


0            .0        500.0           .000

1          69.3           .1          3.205

2          69.3           .1          3.220
0
```

```
   N =   25
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          5020          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10209E+09
0  NP        =          5020          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10256E+09
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                   OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12


0          .0        500.0          .000
```

```
1        70.7          .0          3.235

2        70.7          .0          3.250
0                 OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        2          5    16


0          .0        500.0          .000

1        69.6          .0          3.235

2        69.6          .0          3.250
0                 OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        3          5    17


0          .0        500.0          .000

1        70.5          .0          3.235

2        70.5          .0          3.250
0                 OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        4          4    17


0          .0        500.0          .000

1        70.5          .0          3.235

2        70.5          .0          3.250
0                 OBS.WELL NO.    X     Y
N     HEAD (FT)   CONC.(MG/L)   TIME (YEARS)

                        5          4    14


0          .0        500.0          .000

1        69.3          .1          3.235

2        69.3          .1          3.250
0
```

```
   N =   26
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          5030          IMOV     =          1
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .10304E+09
0  NP       =          5080          IMOV     =          2
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .10351E+09
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0               STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1          5   12



0           .0         500.0          .000
```

```
1        70.7              .0          3.265

2        70.7              .0          3.280
0                    OBS.WELL NO.    X     Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         2           5    16



0          .0           500.0          .000

1        69.6              .0          3.265

2        69.6              .0          3.280
0                    OBS.WELL NO.    X     Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         3           5    17



0          .0           500.0          .000

1        70.5              .0          3.265

2        70.5              .0          3.280
0                    OBS.WELL NO.    X     Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         4           4    17



0          .0           500.0          .000

1        70.5              .0          3.265

2        70.5              .0          3.280
0                    OBS.WELL NO.    X     Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                         5           4    14



0          .0           500.0          .000

1        69.3              .0          3.265

2        69.3              .0          3.280
0
```

```
   N =   27
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1           STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0           THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0           NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          5080          IMOV      =          1
   TIM(N)   =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10398E+09
0  NP       =          5080          IMOV      =          2
   TIM(N)   =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10446E+09
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0              STEADY-STATE SOLUTION



0                      OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME  (YEARS)

                            1          5   12


0         .0         500.0           .000
```

```
1          70.7             .0          3.295

2          70.7             .0          3.310
0                      OBS.WELL NO.    X    Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           2           5   16


0            .0          500.0           .000

1          69.6             .0          3.295

2          69.6             .0          3.310
0                      OBS.WELL NO.    X    Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           3           5   17


0            .0          500.0           .000

1          70.5             .0          3.295

2          70.5             .0          3.310
0                      OBS.WELL NO.    X    Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           4           4   17


0            .0          500.0           .000

1          70.5             .0          3.295

2          70.5             .0          3.310
0                      OBS.WELL NO.    X    Y
N       HEAD (FT)     CONC.(MG/L)    TIME (YEARS)

                           5           4   14


0            .0          500.0           .000

1          69.3             .0          3.295

2          69.3             .0          3.310
0
```

```
   N =    28
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =    .21003E+07
  TIMV (CELDIS)   =    .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0      ***   NOTE   ***         NPTM.EQ.NPMAX --- IMOV=   1
PT. NO.=4620     CALL GENPT

0  NP        =         4032          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10493E+09
0  NP        =         4032          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10540E+09
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

               PUMPING PERIOD NO.    2



0              STEADY-STATE SOLUTION



0                      OBS.WELL NO.     X    Y
N      HEAD (FT)     CONC.(MG/L)     TIME  (YEARS)

                            1           5   12
```

0	.0	500.0	.000
1	70.7	.0	3.325
2	70.7	.0	3.340
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.0	3.325
2	69.6	.0	3.340
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.0	3.325
2	70.5	.0	3.340
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		4	4 17
0	.0	500.0	.000
1	70.5	.0	3.325
2	70.5	.0	3.340
0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		5	4 14
0	.0	500.0	.000
1	69.3	.0	3.325

```
2          69.3                 .1             3.340
0

   N =   29
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP       =          4063          IMOV     =          1
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .10588E+09
0  NP       =          4093          IMOV     =          2
   TIM(N)   =   .94673E+06          TIMV     =   .47336E+06
SUMTCH =   .10635E+09
1Emerson Electric--Altamonte Springs, Florida


0     TIME VERSUS HEAD AND CONCENTRATION AT SELECTED
OBSERVATION POINTS

              PUMPING PERIOD NO.   2



0              STEADY-STATE SOLUTION



0                    OBS.WELL NO.    X    Y
N      HEAD (FT)    CONC.(MG/L)    TIME (YEARS)

                          1           5   12
```

0 .0 500.0 .000

1 70.7 .0 3.355

2 70.7 .0 3.370
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

2 5 16

0 .0 500.0 .000

1 69.6 .0 3.355

2 69.6 .0 3.370
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

3 5 17

0 .0 500.0 .000

1 70.5 .0 3.355

2 70.5 .0 3.370
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

4 4 17

0 .0 500.0 .000

1 70.5 .0 3.355

2 70.5 .0 3.370
0 OBS.WELL NO. X Y
N HEAD (FT) CONC.(MG/L) TIME (YEARS)

5 4 14

0 .0 500.0 .000

1 69.3 .0 3.355

```
2          69.3                 .0            3.370
0

   N =   30
   NUMBER OF ITERATIONS = 0  (HEADS UNCHANGED)
1HEAD DISTRIBUTION - ROW
 NUMBER OF TIME STEPS =     30
        TIME(SECONDS) =   .10730E+09
        TIME(DAYS)    =   .12418E+04
        TIME(YEARS)   =   .34000E+01

0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000    .0000000    .0000000    .0000000
.0000000
0    .0000000    .0000000    .0000000    .0000000
.0000000    .0000000
0    .0000000  79.2999994  79.4999987  79.7999976
79.9999984  80.2999982  80.6999971  80.9999971  81.1999980
81.4999971
0  81.6999975  81.8999975  82.0999979  82.3999967
82.5999960    .0000000
0    .0000000  78.9267228  79.0483875  79.2470866
79.4636865  79.7296602  80.0339915  80.3150803  80.5640474
80.8190801
0  81.0406681  81.2449525  81.4373072  81.6255339
81.7430602    .0000000
0    .0000000  78.4315719  78.5194048  78.6759667
78.8777014  79.1206675  79.3909301  79.6619861  79.9217318
80.1713097
0  80.3983452  80.6015375  80.7784365  80.9214344
81.0034409    .0000000
0    .0000000  77.8487827  77.9220093  78.0599594
78.2507648  78.4846559  78.7473538  79.0204814  79.2898634
79.5463601
0  79.7801430  79.9846955  80.1537527  80.2786422
80.3460228    .0000000
0    .0000000  77.1927652  77.2598977  77.3910991
77.5807436  77.8198389  78.0933497  78.3827239  78.6708821
78.9441259
0  79.1911727  79.4033503  79.5732385  79.6933667
79.7559834    .0000000
0    .0000000  76.4694660  76.5334777  76.6635765
76.8610590  77.1203955  77.4232704  77.7459701  78.0666029
78.3678769
0  78.6368607  78.8640818  79.0422651  79.1653631
79.2284115    .0000000
0    .0000000  75.6822704  75.7411614  75.8688391
76.0796883  76.3775801  76.7335331  77.1114504  77.4818499
77.8240851
0  78.1244777  78.3740188  78.5665462  78.6975999
78.7640034    .0000000
```

0 .0000000 74.8361880 74.8800814 74.9909422
75.2112872 75.5767161 76.0218441 76.4844614 76.9252736
77.3221487
0 77.6629589 77.9409818 78.1523130 78.2945098
78.3660030 .0000000
0 .0000000 73.9461338 73.9519113 74.0034473
74.1976918 74.6960435 75.2925561 75.8791675 76.4125245
76.8761674
0 77.2641177 77.5745261 77.8071003 77.9620007
78.0394173 .0000000
0 .0000000 73.0503403 72.9780544 72.8733020
72.8800483 73.7172690 74.5732280 75.3271872 75.9695485
76.5059377
0 76.9428774 77.2859635 77.5396198 77.7070471
77.7902863 .0000000
0 .0000000 72.2268706 72.0367351 71.6317160
70.7319893 72.7198145 73.9559587 74.8868634 75.6326033
76.2352160
0 76.7155494 77.0868894 77.3584263 77.5363529
77.6244324 .0000000
0 .0000000 71.5934595 71.3101795 70.8847261
71.2518260 72.4739336 73.6438212 74.6315967 75.4386775
76.0866662
0 76.5971076 76.9875102 77.2707314 77.4553859
77.5465811 .0000000
0 .0000000 71.2433318 70.7258180 69.3451932
70.9166656 72.2802840 73.5138068 74.5570358 75.4038549
76.0756748
0 76.5987156 76.9953232 77.2816136 77.4678987
77.5599284 .0000000
0 .0000000 71.4108308 71.0047547 70.4092846
70.7895236 72.2168931 73.5742500 74.6790490 75.5441953
76.2136262
0 76.7269201 77.1136176 77.3926670 77.5748543
77.6654185 .0000000
0 .0000000 71.9842608 71.4728528 70.4974540
69.6150442 72.2233099 73.8870452 75.0405086 75.8800450
76.5075086
0 76.9815160 77.3393536 77.6003694 77.7732002
77.8613277 .0000000
0 .0000000 73.0690966 72.4049485 70.4926356
70.5054454 73.1742580 74.7101131 75.7158961 76.4279685
76.9548482
0 77.3522827 77.6619117 77.8962581 78.0562562
78.1453621 .0000000
0 .0000000 74.8182700 74.5855162 74.1185280
74.2956717 75.2584335 76.0635243 76.6852659 77.1613566
77.5319041
0 77.8111247 78.0600247 78.2667731 78.4105119
78.5186917 .0000000
0 .0000000 76.7999933 76.9999906 77.0999892
77.2999888 77.4999912 77.5999946 77.7999958 77.9999969
78.1999971

0 78.2999985 78.4999984 78.6999980 78.7999989
78.9999974 .0000000
0 .0000000 .0000000 .0000000 .0000000
.0000000 .0000000 .0000000 .0000000 .0000000
.0000000
0 .0000000 .0000000 .0000000 .0000000
.0000000 .0000000

1HEAD DISTRIBUTION - ROW
NUMBER OF TIME STEPS = 30
TIME(SECONDS) = .10730E+09
TIME(DAYS) = .12418E+04
TIME(YEARS) = .34000E+01

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	79	79	80	80	80	81	81	81	81	82	82	82	82	83	0
0	0	79	79	79	79	80	80	80	81	81	81	81	81	82	82	0
0	0	78	79	79	79	79	79	80	80	80	80	81	81	81	81	0
0	0	78	78	78	78	78	79	79	79	80	80	80	80	80	80	0
0	0	77	77	77	78	78	78	78	79	79	79	79	80	80	80	0
0	0	76	77	77	77	77	77	78	78	78	79	79	79	79	79	0
0	0	76	76	76	76	76	77	77	77	78	78	78	79	79	79	0
0	0	75	75	75	75	76	76	76	77	77	78	78	78	78	78	0
0	0	74	74	74	74	75	75	76	76	77	77	78	78	78	78	0
0	0	73	73	73	73	74	75	75	76	77	77	77	78	78	78	0
0	0	72	72	72	71	73	74	75	76	76	77	77	77	78	78	0
0	0	72	71	71	71	72	74	75	75	76	77	77	77	77	78	0
0	0	71	71	69	71	72	74	75	75	76	77	77	77	77	78	0
0	0	71	71	70	71	72	74	75	76	76	77	77	77	78	78	0
0	0	72	71	70	70	72	74	75	76	77	77	77	78	78	78	0
0	0	73	72	70	71	73	75	76	76	77	77	78	78	78	78	0
0	0	75	75	74	74	75	76	77	77	78	78	78	78	78	79	0
0	0	77	77	77	77	77	78	78	78	78	78	78	79	79	79	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1DRAWDOWN

```
        0     0     0     0     0     0     0     0     0     0     0
 0     0     0     0     0
        0     0     0     0     0     0     0     0     0     0     0
 0     0     0     0     0
        0   -79   -79   -79   -79   -80   -80   -80   -81   -81   -81
-81   -81   -82   -82     0
        0   -78   -79   -79   -79   -79   -79   -80   -80   -80   -80
-81   -81   -81   -81     0
        0   -78   -78   -78   -78   -78   -79   -79   -79   -80   -80
-80   -80   -80   -80     0
        0   -77   -77   -77   -78   -78   -78   -78   -79   -79   -79
-79   -80   -80   -80     0
        0   -76   -77   -77   -77   -77   -77   -78   -78   -78   -79
-79   -79   -79   -79     0
        0   -76   -76   -76   -76   -76   -77   -77   -77   -78   -78
-78   -79   -79   -79     0
        0   -75   -75   -75   -75   -76   -76   -76   -77   -77   -78
-78   -78   -78   -78     0
        0   -74   -74   -74   -74   -75   -75   -76   -76   -77   -77
-78   -78   -78   -78     0
        0   -73   -73   -73   -73   -74   -75   -75   -76   -77   -77
-77   -78   -78   -78     0
        0   -72   -72   -72   -71   -73   -74   -75   -76   -76   -77
-77   -77   -78   -78     0
        0   -72   -71   -71   -71   -72   -74   -75   -75   -76   -77
-77   -77   -77   -78     0
        0   -71   -71   -69   -71   -72   -74   -75   -75   -76   -77
-77   -77   -77   -78     0
        0   -71   -71   -70   -71   -72   -74   -75   -76   -76   -77
-77   -77   -78   -78     0
        0   -72   -71   -70   -70   -72   -74   -75   -76   -77   -77
-77   -78   -78   -78     0
        0   -73   -72   -70   -71   -73   -75   -76   -76   -77   -77
-78   -78   -78   -78     0
        0   -75   -75   -74   -74   -75   -76   -77   -77   -78   -78
-78   -78   -78   -79     0
        0     0     0     0     0     0     0     0     0     0     0
 0     0     0     0     0
        0     0     0     0     0     0     0     0     0     0     0
 0     0     0     0     0
0  CUMULATIVE MASS BALANCE -- (IN FT**3)


    RECHARGE AND INJECTION      =   .00000E+00
    PUMPAGE AND E-T WITHDRAWAL =   .69742E+07
    CUMULATIVE  NET  PUMPAGE    =   .69742E+07
    WATER RELEASE FROM STORAGE =   .00000E+00
    LEAKAGE INTO AQUIFER        =   .69748E+07
    LEAKAGE OUT OF AQUIFER      =   .00000E+00
    CUMULATIVE  NET  LEAKAGE    =   .69748E+07
0       MASS BALANCE RESIDUAL   =   522.51
        ERROR  (AS PERCENT)     =   .74917E-02

0  RATE MASS BALANCE -- (IN C.F.S.)
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```
    LEAKAGE INTO AQUIFER         =   .64994E-01
    LEAKAGE OUT OF AQUIFER       =   .00000E+00
    NET LEAKAGE    (QNET)        =   .64994E-01
    RECHARGE AND INJECTION       =   .00000E+00
    PUMPAGE AND E-T WITHDRAWAL =   .65000E-01
    NET WITHDRAWAL   (TPUM)      =   .65000E-01
1          STABILITY CRITERIA --- M.O.C.


0     MAXIMUM FLUID VELOCITIES:  X-VEL =  1.43E-05     Y-VEL
=  2.03E-05
0     MAXIMUM EFFECTIVE SOLUTE VELOCITIES:  X-VEL =  1.06E-
05     Y-VEL =  1.50E-05
0 TMV (MAX. INJ.) =   .21003E+07
  TIMV (CELDIS)   =   .83242E+06
0 TIMV =  8.32E+05     NTIMV =     1     NMOV =     2

   TIM (N)   =   .94673E+06
   TIMEVELO =   .47336E+06
   TIMEDISP =   .10998E+07
0 TIMV =  4.73E+05     NTIMD =     0     NMOV =     2
0          THE LIMITING STABILITY CRITERION IS CELDIS
     MAX. Y-VEL. IS CONSTRAINT AND OCCURS BETWEEN NODES (
5,17) AND ( 5,18)
0          NO. OF PARTICLE MOVES REQUIRED TO COMPLETE THIS
TIME STEP  =    2


0  NP        =          4115          IMOV      =          1
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10682E+09
0  NP        =          4187          IMOV      =          2
   TIM(N)    =   .94673E+06          TIMV      =   .47336E+06
SUMTCH =   .10730E+09
1CONCENTRATION

 NUMBER OF TIME STEPS =    30
       DELTA T        =   .94673E+06
       TIME(SECONDS) =   .10730E+09
   CHEM.TIME(SECONDS) =   .10730E+09
   CHEM.TIME(DAYS)    =   .12418E+04
       TIME(YEARS)    =   .34000E+01
   CHEM.TIME(YEARS)   =   .34000E+01
  NO. MOVES COMPLETED =    2

0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
```

```
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0
0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0    0

 CHEMICAL MASS BALANCE

        MASS IN BOUNDARIES      =    .00000E+00
        MASS OUT BOUNDARIES     =    .00000E+00
        MASS PUMPED IN          =    .00000E+00
        MASS PUMPED OUT         =  -.10469E+09
        MASS LOST BY DECAY      =    .00000E+00
        MASS ADSORBED ON SOLIDS=    .23928E+04
        INITIAL MASS ADSORBED   =    .29182E+08
        INFLOW MINUS OUTFLOW    =  -.10469E+09
        INITIAL MASS DISSOLVED =    .83377E+08
        PRESENT MASS DISSOLVED =    .68365E+04
        CHANGE MASS DISSOLVED   =  -.83370E+08
        CHANGE TOTL.MASS STORED=  -.11255E+09
      COMPARE RESIDUAL WITH NET FLUX AND MASS ACCUMULATION:
        MASS BALANCE RESIDUAL   =    .78616E+07
        ERROR  (AS PERCENT)     =    .00000E+00
      COMPARE INITIAL MASS STORED WITH CHANGE IN MASS
STORED:
```

ERROR (AS PERCENT) = -.36188E+01

1Emerson Electric--Altamonte Springs, Florida

0 TIME VERSUS HEAD AND CONCENTRATION AT SELECTED OBSERVATION POINTS

PUMPING PERIOD NO. 2

0 STEADY-STATE SOLUTION

0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		1	5 12
0	.0	500.0	.000
1	70.7	.0	3.385
2	70.7	.0	3.400

0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		2	5 16
0	.0	500.0	.000
1	69.6	.0	3.385
2	69.6	.0	3.400

0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		3	5 17
0	.0	500.0	.000
1	70.5	.0	3.385
2	70.5	.0	3.400

0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		4	4 17
0	.0	500.0	.000
1	70.5	.0	3.385
2	70.5	.0	3.400

0		OBS.WELL NO.	X Y
N	HEAD (FT)	CONC.(MG/L)	TIME (YEARS)
		5	4 14
0	.0	500.0	.000
1	69.3	.0	3.385
2	69.3	.0	3.400

VITA

Cynthia L. Quast

Master of Science

Thesis: A CASE STUDY REVIEW OF THE EMERSON ELECTRIC SITE USING A METHOD OF CHARACTERISTICS MODEL TO DETERMINE THE SUCCESS OF THE PUMP ND TREAT REMEDIATION

Major Field: Civil Engineering

Biographical:

Personal Data: Born in Oklahoma City, Oklahoma, August 24, 1957, the daughter of Harold and Nelda Sawyer.

Education: Graduated from Mahtomedi High School, Mahtomedi, Minnesota in June 1975; attended Lakewood Community College in White Bear Lake, Minnesota, Augsburg College in Minneapolis, Minnesota, received Bachelor of Science Degree in Civil Engineering from University of Minnesota in March, 1979; completed requirements for the Master of Science degree at Oklahoma State University in December, 1993.

Professional Experience: Design Engineer, Microbial Environmental Services, Incorporated, Des Moines, Iowa, September 1992 to present; Lead Civil Engineer, Fluor Daniel Williams Brothers Engineering Company, Tulsa, Oklahoma, January 1989 to August 1992; Project Engineer, Celanese Chemical Company, Bayport, Texas, May 1981 to August 1984, Project Engineer, Ethyl Corporation, Pasadena, Texas, April 1979 to May 1981.